S
628.53
H2a
1986

PLEASE RETURN

MONTANA AIR QUALITY DATA & INFORMATION SUMMARY FOR 1986

Air Quality Bureau
Environmental Sciences Division
Department of Health
and Environmental Sciences
Helena, Montana 59620

STATE DOCUMENTS COLLECTION
FEB 2 1988
MONTANA STATE LIBRARY
1515 E. 6th AVE.
HELENA, MONTANA 59620

December, 1987

Montana State Library
3 0864 1006 4743 0

MONTANA AIR QUALITY DATA AND INFORMATION SUMMARY FOR 1986

Prepared by:
Air Quality Bureau Staff

Jeffrey T. Chaffee, Chief
Air Quality Bureau
Environmental Sciences Division
Department of Health and Environmental Sciences
Helena, Montana 59620

December 1987

Table of Contents

	Page
List of Tables	ii
List of Figures	iv
Introduction	1
AQCR 140 - South Central Montana	5
AQCR 141 - North Central Montana	42
AQCR 142 - Southwestern Montana	53
AQCR 143 - Eastern Montana	76
AQCR 144 - Northwestern Montana	85

APPENDICES

A - Glossary of Air Quality Terms	110
B - Ambient Air Quality Standards	124
C - Attainment-Nonattainment Designations	128
D - Precision and Accuracy	140
E - List of Air Quality Publications	156
F - Point Source Emission Estimates	160
G - Prevention of Significant Deterioration	166
H - Air Quality Data Reports	170
I - Air Quality Data Plots	184
J - Smoke Management	201
K - Hi-vol Schedules	203
L - Visible Emission Documentation	207
M - Air Quality Personnel	211
N - Air Monitoring Equipment	215
O - Air Quality Data Processing Information	225
P - Acronyms and Abbreviations	231
Q - AQCR's and Area Codes	235

List of Tables

Table	Title	Page
1.	AQCR 140 - Monitoring Site Descriptions.	10
2.	AQCR 140 - Total Suspended Particulates.	13
3.	AQCR 140 - TSP - Number of Exceedances	15
4.	AQCR 140 - Carbon Monoxide	17
5.	AQCR 140 - CO - Number of Exceedances	20
6.	AQCR 140 - Sulfur Dioxide.	21
7.	AQCR 140 - SO2 - Number of Exceedances	30
8.	AQCR 140 - Sulfation Rate.	31
9.	AQCR 140 - Respirable Particulates (PM10).	37
10.	AQCR 141 - Monitoring Site Descriptions.	46
11.	AQCR 141 - Total Suspended Particulates.	47
12.	AQCR 141 - TSP - Number of Exceedances	48
13.	AQCR 141 - Carbon Monoxide	50
14.	AQCR 141 - CO - Number of Exceedances.	52
15.	AQCR 141 - Respirable Particulates (PM10).	52
16.	AQCR 142 - Monitoring Site Descriptions.	59
17.	AQCR 142 - Total Suspended Particulates.	61
18.	AQCR 142 - TSP - Number of Exceedances	65
19.	AQCR 142 - Arsenic	68
20.	AQCR 142 - Copper.	68
21.	AQCR 142 - Lead (Daily).	69
22.	AQCR 142 - Lead (Quarterly).	70
23.	AQCR 142 - Lead - Number of Exceedances.	71
24.	AQCR 142 - Zinc.	74
25.	AQCR 142 - Respirable Particulates (PM10).	75
26.	AQCR 143 - Monitoring Site Descriptions.	80
27.	AQCR 143 - Total Suspended Particulates.	82
28.	AQCR 143 - TSP - Number of Exceedances	83
29.	AQCR 143 - Sulfur Dioxide.	84
30.	AQCR 143 - SO2 - Number of Exceedances	84
31.	AQCR 144 - Monitoring Site Descriptions.	91
32.	AQCR 144 - Total Suspended Particulates.	93
33.	AQCR 144 - TSP - Number of Exceedances	97
34.	AQCR 144 - Visibility.	100
35.	AQCR 144 - Sulfates.	102
36.	AQCR 144 - Carbon Monoxide	103
37.	AQCR 144 - CO - Number of Exceedances.	107
38.	AQCR 144 - Respirable Particulates (PM15).	107
39.	AQCR 144 - Respirable Particulates (PM10).	108

Tables in Appendices

Table	Title	Page
AP-B-I	Montana and National Ambient Air Quality Standards. . . .	125
AP-C-I	Attainment Status	129
AP-C-II	PM10 Groupings and SIP Requirements	132
AP-D-I	Precision	141
AP-D-II	Accuracy.	145
AP-D-III	TSP Site/Audit List	151
AP-F-I	Point Source Sulfur Dioxide Emission Estimates	160
AP-F-II	Point Source Particulate Emission Estimates	162
AP-G-I	Federal PSD Allowable Increments.	167
AP-G-II	Montana Federal Class I Areas	167
AP-N-I	Pollutants and Analytical Procedures.	215
AP-Q-I	Montana Area Codes.	237

List of Figures

Figure	Title	Page
1.	AQCR 140 - TSP Annual Averages	16
2.	AQCR 140 - Sulfation Rate - Billings	38
3.	AQCR 140 - Sulfation Rate - Laurel	39
4.	AQCR 140 - Sulfation Plate Sites	40
5.	AQCR 140 - Sulfation Rate Isopleth	41
6.	AQCR 141 - TSP Annual Averages	49
7.	AQCR 142 - TSP Annual Averages	67
8.	AQCR 142 - Lead Quarterly Averages - Firehall Site	72
9.	AQCR 142 - Lead Quarterly Averages - Hadfield Site	72
10.	AQCR 142 - Lead Quarterly Averages - Dartman Field	73
11.	AQCR 144 - TSP Annual Averages	99

Figures in Appendices

AP-1-G	PSD Class I Areas in Montana	168
AP-1-H	East Helena - Firehall Lead - 1986	171
AP-2-H	Helena - Cogswell Building - TSP - 1986.	172
AP-3-H	Missoula - Rose Park - TSP - 1985	173
AP-4-H	Billings - Coburn Road - SO_2 - November 1986	174
AP-5-H	Great Falls - Pardis Clinic - CO - October 1986.	176
AP-6-H	East Helena - Firehall - 1986.	178
AP-7-H	Billings - Lockwood Park - 1986.	179
AP-8-H	Billings - Lockwood Park - 1986.	180
AP-9-H	Scobey - Marlenee Ranch - 1986	181
AP-10-H	Libby - Lincoln County Courthouse - TSP - 1986	182
AP-11-H	East Helena - Hadfield - Lead - 1986	183
AP-1-I	Billings - City Hall - 1986.	185
AP-2-I	Great Falls - Fire Station #1 - 1986	186
AP-3-I	Butte - Greeley School - 1986.	187
AP-4-I	Libby - Lincoln County Courthouse - 1986	188
AP-5-I	Eureka - Lincoln Electric Co-op - 1986	189
AP-6-I	Libby - Lincoln County Courthouse - 1984-86.	190
AP-7-I	Missoula - Boyd Park - 1984-86	191
AP-8-I	Kalispell - Universal Athletics - 1984-86.	192
AP-9-I	Missoula - Malfunction Jct. - August 1986.	193
AP-10-I	Great Falls - Pardis Clinic - December 1986.	194
AP-11-I	Billings - Lockwood Park - January 1986.	195
AP-12-I	Billings - Coburn Road - August 1986	196
AP-13-I	East Helena - Firehall - 1986.	197
AP-14-I	East Helena - Hadfield - 1986.	198
AP-15-I	East Helena - Firehall - 1984-86	199
AP-16-I	East Helena - Hadfield - 1984-86	200

Figure	Title	Page
AP-1-J	Montana Smoke Management Airsheds.	202
AP-1-K	1987 Hi-vol Schedule	204
AP-2-K	1988 Hi-vol Schedule	205
AP-1-L	Smoke Generator.	209
AP-2-L	Visible Emissions Documentation Form	210
AP-1-M	AQB Organizational Chart - November 1986	212
AP-2-M	AQB Organizational Chart - October 1987.	213
AP-1-O	Data Entry Form - 2179	226
AP-2-O	Data Entry Form - BAC.	227
AP-3-O	Data Entry Form - BAQ.	228
AP-4-O	Data Entry Form - SAROAD	229
AP-1-Q	Montana Air Quality Control Regions.	236

Digitized by the Internet Archive
in 2015

https://archive.org/details/montanaairqualit1986mont

Introduction

The purpose of the Montana Air Quality Data and Information Summary for 1986 is to summarize air quality data collected within the state and to provide information on air quality topics.

With the adoption of the Clean Air Act, EPA divided the state into five geographical regions. Each of these Air Quality Control Regions (AQCRs) contains distinct meteorological patterns, topography and industrial influences (see Appendix Q). This report will address the monitoring activities by AQCR. Within each region, various background information is provided. This includes: location of the AQCR, physical features, population, types of pollution sources, monitoring site descriptions, summaries of the air quality data, and the number of data values exceeding the federal and Montana ambient standards.

The air quality data summaries have been tabulated to show the following: site code, site name, year of record, month, number of observations, first, second and third maxima, arithmetic mean,

three-hour maximum (SO_2), eight-hour maximum (CO), 24-hour maximum (SO_2), and geometric mean (TSP).

In south central Montana (AQCR 140), the major air pollution problem involves SO_2 in Billings from a coal-fired power plant and three oil refineries. There were no violations of the federal standards in 1986. Two of the three monitoring sites recorded violations of the Montana 24-hour standard and there was one violation of the Montana annual SO_2 standards. There were exceedances of the standards at another site but, because of insufficient data recovery, it can not be classed as a violation.

In north central Montana (AQCR 141), a minor problem exists with carbon monoxide and particulate matter in Great Falls. There were violations of the Montana 24-hour standards for TSP at one site but no violations of the TSP annual standard. There were two violations of the Montana and federal 8-hour standards for CO.

In southwest Montana (AQCR 142), the major air pollution problems involve particulate matter and lead. High concentrations of lead at three sites in the East Helena area resulted in nine violations of the federal calendar quarter standard. There have been some downward trends in lead concentrations for the past few years due to control measures instituted at the primary lead smelter. The winter quarters continue to show the highest concentrations and are most resistant to the control strategies.

In eastern Montana (AQCR 143), there were no violations of any air pollution standards. Sulfur dioxide was a minor problem; sources included coal-fired power plants and oil well flares and vents.

In western Montana (AQCR 144), the major air pollution problem is particulate matter. There is also some concern with carbon monoxide. There were five sites that violated the federal annual TSP standards and seven sites that violated the Montana annual TSP standard. There were nine sites that violated both the federal and Montana 24-hour TSP standards. There was one violation of the eight hour CO standard of 9 ppm at the Boyd Park site in Missoula and one violation of the Montana 1-hour standard of 23 ppm.

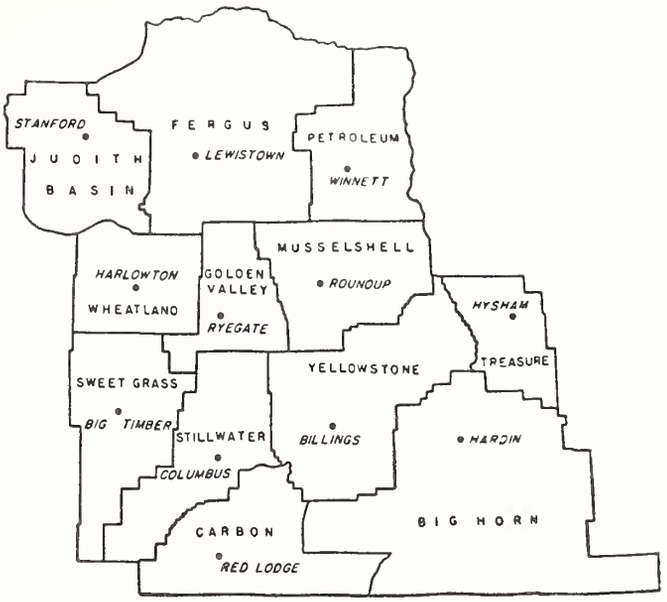
The air quality programs in the future will be taking us into new areas. The bureau was reorganized in 1986 and added a section to address air toxics and SIP development. EPA is placing emphasis on identifying sources of toxic air pollutants and controlling these substances. This section is compiling an inventory of toxic air pollutants and is developing control strategies for other criteria pollutants in Montana.

EPA adopted a new PM-10 standard in 1987 which will replace the existing standard for TSP. PM-10 refers to particulate matter with an aerodynamic diameter of 10 microns or less, also called inhalable or respirable particulate. The smaller size particles have been identified as carrying a greater health risk as they can be drawn deep into the lungs. The new PM-10 standards will affect the present air monitoring network, the number of stations, type of equipment and control strategies used by the bureau to maintain the ambient air quality standards. Appendix C contains more information on the PM-10 standards and how they will affect the state air programs.

In the second half of this report, several appendices are provided on a variety of topics relating to air quality. These include discussions on Prevention of Significant Deterioration, Attainment-Nonattainment Designations, Ambient Air Quality Standards, Smoke Management and Visible Emission Documentation. Other miscellaneous tables, lists and short reports are included for the reader's benefit and informational needs.

This report was compiled for use by the general public to provide a brief overview of the air quality of Montana. The subject of air quality is often complicated and data-intensive. The issues can be emotional and volatile, especially during present times when economic security and air pollution control sometimes seem to be at odds with one another.

The Air Quality Bureau (AQB) has a small technical library of air quality publications, and various statistical reports and data summaries, all available to the general public. The staff of the AQB is also available to answer questions and provide insights into the air quality of Montana.



AQCR 140

South central Montana

LOCATION AND PHYSICAL FEATURES

AQCR 140 is located in southcentral Montana. Physical features include mountainous areas, foothills and sedimentary plains. The Yellowstone and Musselshell Rivers flow from west to east and cut through the region. The Missouri River borders the region on the north. Wyoming borders it on the south.

POPULATION

The 1986 estimated population of AQCR 140 is 174,400 or approximately 21 percent of the state population. The majority of people in this region live in Yellowstone County (Billings and Laurel), which continues to exhibit the most vigorous growth. Several counties have declined in population since the 1980 census.

POLLUTION SOURCES

Pollution sources and types of pollutants are listed for each county in the region. A final category lists the types of sources that would be expected in all counties in the region. The sources by county are as follows:

Big Horn County

- Four coal strip mines (particulates)

Carbon County

- Calcium manufacturing (particulates)

Yellowstone County

- Three oil refineries (SO_2, H_2S, NOx, SO_3, particulates)
- Coal-fired power plant (SO_2, NOx, particulates)
- Sugar beet refinery (SO_2, NOx, particulates)
- Sulfur plant (SO_2, SO_3)
- Grain processing (particulates)

All Counties

- Asphalt plants (particulates)
- Gravel crushers (particulates)
- Home heating devices (particulates, CO)
- Automobiles (CO, NOx, re-entrained particulates)
- Agricultural activities (particulates)
- Wind erosion (particulates)

MONITORING SITE DESCRIPTIONS

The Billings/Laurel area is the population and industrial center for AQCR 140. Consequently, the monitoring effort has been concentrated in this location. Table 1 lists the monitoring site descriptions. This includes site codes, site name, supporting agency, station type, project description, city name and county name, and the parameter or pollutant monitored in 1986.

DATA SUMMARY

Total Suspended Particulates

TSP was monitored at five sites in this region in 1986. One site ran a collocated sampler. The maximum 24-hour observation was 225 $\mu g/m^3$ at the Lockwood Park site in Billings. The highest annual geometric average was 62.9 $\mu g/m^3$ at the City Hall site and the next highest was 60.9 $\mu g/m^3$ at the Grand Avenue School site. Table 2 summarizes the TSP data for this region and Table 3 shows the number of exceedances of the federal and Montana standards. Figure 1 shows a three-year comparison of the annual averages for this region's TSP sites. All sites in the Billings/Laurel area remained within the federal and state standards for TSP.

Carbon Monoxide

Carbon monoxide was monitored at the Billings Metra-Fairgrounds site for just three months in 1986. The past years of monitoring have shown that CO does not seem to be a problem at this site. CO monitoring will be resumed in 1987 at another location where higher concentrations may be more likely. Table 4 summarizes the CO data at the Metra site and Table 5 shows the number of exceedances.

Sulfur Dioxide

Sulfur dioxide was monitored at three sites in Billings in 1986. The maximum one hour reading was .603 ppm at the Coburn Road site. The maximum three hour average was .467 ppm at Coburn Road. The maximum twenty-four hour average was .115 ppm at the Lockwood Park site. The highest annual average in the area was .026 ppm at the Coburn Road site. There were no violations of the federal standards. Two sites had violations of the Montana standards. The North Johnson Lane site was shut down in June due to various equipment and personnel considerations. In 1987, the Billings industries will operate several SO_2 analyzers as part of a cooperative effort to monitor the concentrations of SO_2 in the Billings area. Under this agreement there will be a site located within the general area of North Johnson Lane. Table 6 summarizes the SO_2 data for this region for the past five years while Table 7 shows the number of exceedances.

Sulfation Rate

Sulfation rate was monitored primarily at 36 sites in Yellowstone County. The highest monthly observation was 2.02 mg SO_3/100 cm^2/day at the Johnson Road North site. The highest annual average was 1.28 mg SO_3/100 cm^2/day, also at the Johnson Road North site. There is no standard for sulfation rate; however, readings greater than 0.5 mg SO_3/100 cm^2/day indicate possible trouble spots and warrant continued sampling. Table 8 summarizes the sulfation rate data. Figures 2 and 3 show a three-year comparison of the sulfation rate data at the Billings and Laurel sites.

Because of the continued high interest in the sulfur dioxide levels in the Billings/Laurel area, the regular sulfation plate network was temporarily expanded from September to December, 1986. A total of 101 sites were established throughout the Yellowstone Valley from Park City to Worden. Figure 4 shows the locations of these sites. From the resulting data base, isopleth maps of concentrations were drawn. Figure 5 is an isopleth of the October, 1986 data. The information gathered will be a useful tool in the following areas: 1) identifying the areas impacted by sulfur dioxide; 2) determining the reasonableness of dispersion modeling results; and 3) locating future monitoring sites.

A report printed by the bureau in April, 1987, Geographical Distribution of Sulfur Dioxide in the Vicinity of Billings, Montana, presents the background and findings of this additional monitoring.

Respirable Particulates (PM-10)

Particulate matter less than 10 microns (PM-10) was monitored at the Grand Avenue School during 1986. The maximum 24-hour observation was 84 $\mu g/m^3$. PM-10 gives an indication of the respirable portion of TSP concentrations. Table 9 summarizes the PM-10 data for this site.

TABLE 1a

AQCR 140 - MONITORING SITE DESCRIPTIONS

AREA/SITE CODE	SITE NAME/ADDRESS SUPPORTING AGENCY	STATION TYPE PROJECT DESCRIPTION	CITY COUNTY	PARAMETER
0080 001 G 02	214 PUEBLO STREET YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-RESIDENTIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 003 G 02	113 BITTERROOT DRIVE YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-NEAR URBAN SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 004 G 02	114 JOHNSON LANE YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-AGRICULTURAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 006 G 02	LOCKWOOD SCHOOL YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-INDUSTRIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 007 G 01	KGHL STATION, WEST OF BILLINGS ON HWY 10 YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-AGRICULTURAL POPULATION ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 008 G 01	CITY HALL, 3RD AVE NORTH & 27TH STREET YELLOWSTONE COUNTY AIR POLLUTION CONTROL	CITY CENTER-COMMERCIAL POPULATION ORIENTED	BILLINGS YELLOWSTONE	TSP, SULFATION RATE
0080 008 G 07	3RD AVE N. & 27TH STREET YELLOWSTONE COUNTY AIR POLLUTION CONTROL	CITY CENTER-COMMERCIAL QA-COLOCATED SAMPLER	BILLINGS YELLOWSTONE	TSP
0080 010 G 02	GARDEN AVENUE YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-INDUSTRIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 011 G 02	33RD STREET AND 2ND AVENUE NORTH YELLOWSTONE COUNTY AIR POLLUTION CONTROL	CITY CENTER-COMMERCIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 014 G 02	MOUNTAIN VIEW BLVD YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-RESIDENTIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 017 G 02	MINNESOTA AVENUE, 1/2 MI NE OF CONOCO YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-INDUSTRIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 018 G 02	5TH STREET & SOUTH 28TH YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-RESIDENTIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 019 G 02	SOUTH 27TH & 11TH AVENUE SOUTH YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-COMMERCIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 021 G 02	EAST OF CONOCO REFINERY YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-INDUSTRIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 022 G 02	TWO MOON PARK, A MILE NE OF CONOCO YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-INDUSTRIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 025 G 02	STATE STREET & 3RD SOUTH YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-RESIDENTIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE

TABLE 1b

AQCR 140 - MONITORING SITE DESCRIPTIONS

AREA/SITE CODE	SITE NAME/ADDRESS SUPPORTING AGENCY	STATION TYPE PROJECT DESCRIPTION	CITY COUNTY	PARAMETER
0080 027 G 02	NEWMAN SCHOOL, STONE & S BILLINGS BLVD YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-RESIDENTIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 028 G 02	BENCH SCHOOL, MILTON ROAD YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-RESIDENTIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 032 G 02	KLENCK LAND, 3/4 MILE S OF EXXON REFINERY YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-INDUSTRIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 034 G 02	PICCOLO & FRONTAGE ROAD YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-INDUSTRIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 037 G 02	JOHNSON & LOCKWOOD YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-AGRICULTURAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 038 G 02	JOHNSON ROAD NORTH, 1 MILE NE OF EXXON YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-AGRICULTURAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 061 G 02	METRA PARKING LOT,6TH AVE & EXHIBITION DR YELLOWSTONE COUNTY AIR POLLUTION CONTROL	CITY CENTER-COMMERCIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	CO, SULFATION RATE, WIND
0080 064 F 05	NORTH JOHNSON LANE MONTANA AIR QUALITY BUREAU	SUBURBAN-INDUSTRIAL SPECIAL STUDIES	BILLINGS YELLOWSTONE	SO2, WIND
0080 065 F 01	LOCKWOOD PARK (NAMS SITE) MONTANA AIR QUALITY BUREAU	SUBURBAN-RESIDENTIAL POPULATION ORIENTED	BILLINGS YELLOWSTONE	TSP, SO2, WIND
0080 065 G 02	LOCKWOOD PARK YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-RESIDENTIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 066 F 05	COBURN ROAD, SOUTH OF BILLINGS MONTANA AIR QUALITY BUREAU	RURAL-NEAR URBAN SPECIAL STUDIES	BILLINGS YELLOWSTONE	SO2, WIND
0080 066 G 02	COBURN ROAD YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-NEAR URBAN SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 067 G 01	SANDSTONE SCHOOL, 1440 NUTTER BLVD YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-RESIDENTIAL POPULATION ORIENTED	BILLINGS YELLOWSTONE	TSP, SULFATION RATE
0080 072 G 01	GRAND AVENUE, 1320 GRAND AVENUE YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-COMMERCIAL POPULATION ORIENTED	BILLINGS YELLOWSTONE	TSP, SULFATION RATE, PHIO
0840 001 G 02	LAUREL JUNIOR HIGH - 410 COLORADO AVE YELLOWSTONE COUNTY AIR POLLUTION CONTROL	CITY CENTER-RESIDENTIAL SOURCE ORIENTED	LAUREL YELLOWSTONE	TSP, SULFATION RATE
0840 003 G 02	ROADHOUSE ROAD - 1 MI NE OF CENEX YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-INDUSTRIAL SOURCE ORIENTED	LAUREL YELLOWSTONE	SULFATION RATE

AREA/SITE CODE	SITE NAME/ADDRESS SUPPORTING AGENCY	STATION TYPE PROJECT DESCRIPTION	CITY COUNTY	PARAMETER
0840 004 G 02	CITY SEW TRTMT PLANT - 3/4 MI N OF CENEX YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-NEAR URBAN SOURCE ORIENTED	LAUREL YELLOWSTONE	SULFATION RATE
0840 005 G 02	LAUREL WATER PLANT - 1/2 MI S OF CENEX YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-NEAR URBAN SOURCE ORIENTED	LAUREL YELLOWSTONE	SULFATION RATE
0840 006 G 02	WEST LAUREL CHURCH - 1/2 MI WNW OF CENEX YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-RESIDENTIAL SOURCE ORIENTED	LAUREL YELLOWSTONE	SULFATION RATE
0840 007 G 02	A & W ROOT BEER - 1/2 MI NNW OF CENEX YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-COMMERCIAL SOURCE ORIENTED	LAUREL YELLOWSTONE	SULFATION RATE
0840 008 G 02	EAST OF LAUREL - 3/4 MI NE OF CENEX YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-NEAR URBAN SOURCE ORIENTED	LAUREL YELLOWSTONE	SULFATION RATE
0840 009 G 02	FARM EAST OF CENEX - 3/8 MI NE OF CENEX YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-AGRICULTURAL SOURCE ORIENTED	LAUREL YELLOWSTONE	SULFATION RATE
0840 010 G 02	ROOTBEER STAND - 1 3/4 MI NE OF CENEX YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-COMMERCIAL SOURCE ORIENTED	LAUREL YELLOWSTONE	SULFATION RATE
0840 013 G 02	WEST COOP - 1/4 MI WEST OF CENEX YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-INDUSTRIAL SOURCE ORIENTED	LAUREL YELLOWSTONE	SULFATION RATE

PARAMETER ABBREVIATIONS

TSP	TOTAL SUSPENDED PARTICULATES
PM10	PARTICULATE MATTER 10 (SIZE 10 MICRONS AND UNDER)
PM15	PARTICULATE MATTER 15 (SIZE 15 MICRONS AND UNDER)
DICHOT	DICHOTOMOUS SAMPLER (FINE, COARSE, AND TOTAL PARTICULATES)
CO	CARBON MONOXIDE
SO2	SULFUR DIOXIDE
WIND	WIND SPEED, WIND DIRECTION AND TEMPERATURE

TABLE 2a
AQCR 140 - TOTAL SUSPENDED PARTICULATES
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean	Geom Mean
Yellowstone/Billings								
0080 008 G 01	City Hall	82	55	153	109	107	65.4	59.9
		83	55	152	127	107	60.3	55.6
		84	58	143	133	131	69.5	63.3
		85	59	176	135	130	61.5	55.8
		86	56	154	123	119	70.7	62.9
0080 008 G 07	City Hall - Collocated	82	57	165	112	107	64.9	59.6
		83	52	153	127	106	62.3	58.3
		84	59	144	139	137	70.1	64.0
		85	60	190	143	139	64.3	57.8
		86	56	159	121	121	68.1	60.6
0080 065 F 01	Lockwood Park	83	21	293	186	148	75.9	60.1
		84	57	187	153	148	64.5	52.8
		85	57	148	133	123	60.7	52.0
		86	56	225	178	151	71.2	60.3
0080 067 G 01	Sandstone School	83	47	76	61	54	31.2	27.9
		84	54	108	81	72	34.8	29.8
		85	57	96	92	71	36.3	31.8
		86	59	89	87	74	41.1	36.1
0080 072 G 01	Grand Avenue School	82	56	124	119	103	60.4	56.4
		83	53	148	143	131	57.2	51.4
		84	55	138	106	102	63.2	58.0
		85	58	237	165	121	61.1	53.7
		86	57	175	169	165	69.9	60.9

TABLE 2b
AQCR 140 - TOTAL SUSPENDED PARTICULATES
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean	Geom Mean
Yellowstone/Laurel								
0840 001 G 02	Laurel Junior High	82	55	77	74	73	37.6	33.8
		83	53	81	59	59	37.8	35.0
		84	55	107	92	76	41.9	37.0
		85	53	97	91	72	39.3	35.4
		86	57	115	90	80	43.5	38.3

TABLE 3
AQCR 140 - TSP - Number of Exceedances
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Federal Daily 260	Prim Annual G 75	Federal Daily 150	Sec Annual G 60	Montana Daily 200	Std Annual A 75
Yellowstone/Billings									
0080 008 G 01	City Hall	85	59	0	0	1	0	0	0
		86	56	0	0	1	0	0	0
0080 065 F 01	Lockwood Park	85	57	0	0	0	0	0	0
		86	56	0	0	4	0	1	0
0080 067 G 01	Sandstone School	85	57	0	0	0	0	0	0
		86	59	0	0	0	0	0	0
0080 072 G 01	Grand Avenue School	85	60	0	0	2	0	1	0
		86	57	0	0	4	1	0	0
Yellowstone/Laurel									
0840 001 G 02	Laurel Junior High	85	53	0	0	0	0	0	0
		86	57	0	0	0	0	0	0

FIGURE 1

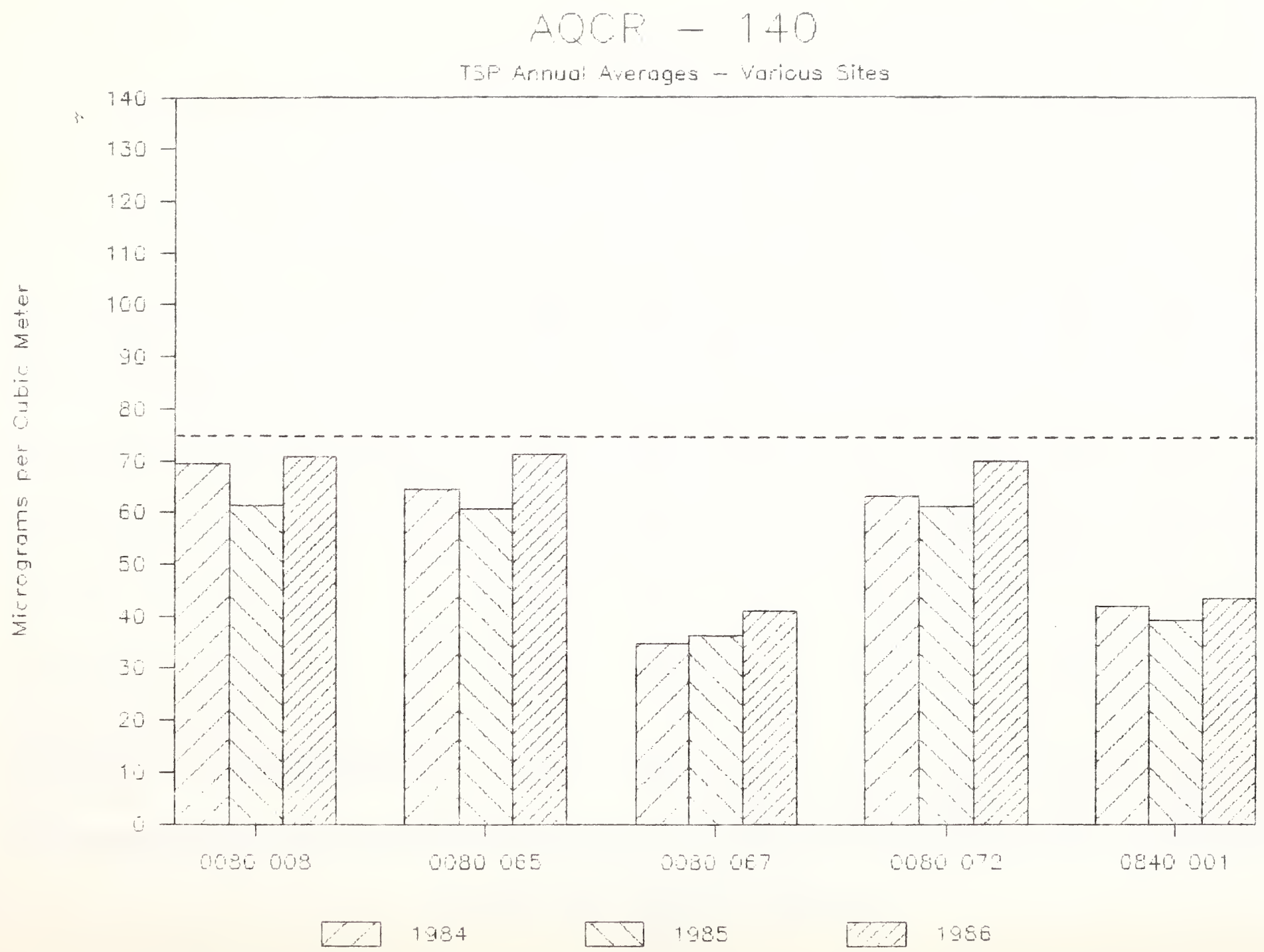

AQCR - 140
TSP Annual Averages - Various Sites
Micrograms per Cubic Meter
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0080 008
0080 065
0080 067
0080 072
0840 001
1984
1985
1986

TABLE 4a
AQCR 140 - CARBON MONOXIDE
Parts Per Million

Site Code	Site Name/Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	8 Hr Max	Monthly Average
0080 061 F 02	Metra - Fairgrounds	82	01	738	17.5	11.2	6.8	5.2	1.5
			02	583	10.9	9.1	8.4	5.3	2.0
			03	737	8.7	8.1	7.1	4.7	1.8
			04	539	12.1	4.2	4.1	3.3	1.3
			05	175	3.0	2.5	2.5	1.8	1.0
			06	659	9.0	8.3	5.0	2.9	1.2
			07	705	10.0	5.0	4.5	3.3	1.2
			08	565	5.2	4.9	4.0	2.5	1.0
			09	684	14.3	10.2	7.5	3.6	1.1
			10	737	9.9	9.9	8.7	5.4	1.6
			11	431	11.5	10.5	10.5	7.3	1.8
			12	---	---	---	---	---	---
		ANNUAL		6553	17.5	14.3	12.1	7.3	---
0080 061 F 02	Metra - Fairgrounds	83	01	680	23.9	11.2	10.9	9.8	1.9
			02	668	12.8	12.0	10.9	6.0	1.9
			03	513	12.9	11.8	8.7	6.9	1.2
			04	704	3.4	3.0	2.9	2.0	.7
			05	737	4.3	3.3	3.2	2.5	.9
			06	281	3.4	2.4	2.3	1.5	.9
			07	---	---	---	---	---	---
			08	---	---	---	---	---	---
			09	---	---	---	---	---	---
			10	435	12.6	9.7	7.6	5.9	1.7
			11	711	20.0	13.5	8.0	5.7	1.1
			12	406	8.3	7.8	7.1	4.9	1.2
		ANNUAL		5135	23.9	20.0	13.5	9.8	---

TABLE 4b
AQCR 140 - CARBON MONOXIDE
Parts Per Million

Site Code	Site Name/Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	8 Hr Max	Monthly Average
0080 061 G 02	Metra - Fairgrounds	84	01	---	---	---	---	---	---
			02	152	6.1	5.7	4.5	2.6	1.0
			03	272	5.8	5.4	4.2	2.6	0.8
			04	---	---	---	---	---	---
			05	102	3.5	3.3	2.2	1.6	0.7
			06	151	4.0	4.0	2.8	1.4	0.4
			07	---	---	---	---	---	---
			08	139	1.0	0.8	0.8	0.6	0.1
			09	216	5.7	3.4	3.4	2.9	1.2
			10	654	11.1	8.7	7.7	5.1	0.9
			11	715	6.3	6.0	5.8	4.6	1.3
			12	705	8.0	7.8	7.7	7.0	1.4
		ANNUAL		3106	11.1	8.7	8.0	7.0	---
0080 061 G 02	Metra - Fairgrounds	85	01	500	4.8	4.5	4.4	3.3	0.8
			02	500	9.4	8.2	6.0	3.4	1.0
			03	740	8.2	6.9	5.6	4.5	1.3
			04	715	4.1	2.9	2.7	2.0	0.7
			05	705	9.5	4.4	3.5	2.4	0.4
			06	703	4.6	3.6	3.5	2.6	0.4
			07	737	10.5	5.1	4.9	4.0	1.4
			08	737	6.4	3.9	3.8	3.0	1.0
			09	564	3.4	3.2	2.8	2.4	0.8
			10	377	4.4	4.3	4.3	3.5	1.3
			11	277	3.8	3.5	3.5	3.1	1.3
			12	445	4.0	3.5	3.5	2.8	1.0
		ANNUAL		7000	10.5	9.5	9.4	4.5	---

TABLE 4c
AQCR 140 - CARBON MONOXIDE
Parts Per Million

Site Code	Site Name/Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	8 Hr Max	Monthly Average
0080 061 G 02	Metra - Fairgrounds	86	01	736	9.6	9.0	7.9	5.6	1.3
			02	668	6.6	6.2	5.4	5.2	1.4
			03	738	4.6	4.5	4.4	4.0	1.3
			04	---	---	---	---	---	---
			05	---	---	---	---	---	---
			06	---	---	---	---	---	---
			07	---	---	---	---	---	---
			08	---	---	---	---	---	---
			09	---	---	---	---	---	---
			10	---	---	---	---	---	---
			11	---	---	---	---	---	---
			12	---	---	---	---	---	---
		ANNUAL		2142	9.6	9.0	7.9	5.6	---

TABLE 5
AQCR 140 - CO - Number of Exceedances
Parts per Million

County/City Site Code	Site Name/Location	Yr	Num Obs	Federal Prim 1-Hr 35	Federal Prim 8-Hr 9	Montana Std 1-Hr 23	Montana Std 8-Hr 9
Yellowstone/Billings							
0080 061 G 02	Metra-Fairgrounds	85	7000	0	0	0	0
		86	2142	0	0	0	0

TABLE 6a
AQCR 140 - SULFUR DIOXIDE
Parts Per Million

Site Code	Site Name/Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	3 Hr Max	24 Hr Max	Monthly Average
0080 064 F 05	North Johnson Lane	82	01	728	.381	.328	.326	.353	.111	.021
			02	619	.355	.335	.330	.230	.131	.037
			03	693	.216	.191	.163	.168	.058	.014
			04	655	.304	.210	.170	.175	.048	.012
			05	730	.220	.189	.175	.194	.035	.008
			06	700	.210	.190	.175	.166	.035	.011
			07	683	.325	.266	.247	.235	.051	.014
			08	722	.425	.277	.250	.226	.056	.021
			09	549	.716	.340	.320	.517	.065	.025
			10	549	.384	.320	.294	.277	.096	.028
			11	714	.250	.237	.232	.206	.102	.029
			12	734	.364	.295	.269	.309	.099	.029
		ANNUAL		8076	.716	.425	.384	.517	.131	.020
0080 064 F 05	North Johnson Lane	83	01	737	.375	.363	.338	.263	.119	.040
			02	668	.374	.324	.306	.262	.083	.030
			03	678	.357	.310	.299	.259	.049	.013
			04	708	.458	.262	.215	.261	.046	.007
			05	483	.203	.192	.156	.138	.052	.012
			06	---	---	---	---	---	---	---
			07	---	---	---	---	---	---	---
			08	---	---	---	---	---	---	---
			09	---	---	---	---	---	---	---
			10	348	.253	.217	.208	.181	.092	.037
			11	716	.317	.271	.266	.213	.112	.029
			12	604	.392	.364	.353	.301	.120	.032
		ANNUAL		4942	.458	.392	.375	.301	.120	.024

TABLE 6b
AQCR 140 - SULFUR DIOXIDE
Parts Per Million

Site Code	Site Name/Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	3 Hr Max	24 Hr Max	Monthly Average
0080 064 F 05	North Johnson Lane	84	01	722	.233	.233	.226	.211	.088	.025
			02	687	.256	.219	.196	.190	.067	.020
			03	724	.160	.159	.158	.136	.042	.008
			04	329	.135	.110	.070	.097	.018	.002
			05	519	.425	.228	.210	.248	.053	.011
			06	331	.170	.135	.130	.119	.031	.009
			07	57	.107	.068	.068	.055	.024	.015
			08	665	.287	.268	.250	.207	.048	.021
			09	710	.520	.425	.400	.448	.118	.015
			10	61	.300	.250	.210	.233	.094	.062
			11	---	---	---	---	---	---	---
			12	529	.460	.315	.310	.333	.098	.035
		ANNUAL		5334	.520	.460	.425	.448	.118	.018
0080 064 F 05	North Johnson Lane	85	01	714	.414	.410	.377	.303	.149	.041
			02	524	.274	.254	.227	.215	.067	.021
			03	675	.351	.297	.291	.280	.072	.016
			04	623	.219	.196	.188	.171	.038	.008
			05	556	.219	.214	.183	.152	.031	.010
			06	710	.313	.245	.217	.245	.050	.008
			07	739	.364	.256	.226	.230	.061	.017
			08	207	.187	.147	.133	.152	.045	.010
			09	447	.155	.153	.106	.106	.023	.005
			10	740	.329	.254	.204	.234	.066	.019
			11	714	.367	.292	.229	.233	.101	.016
			12	640	.345	.232	.221	.188	.130	.033
		ANNUAL		7289	.414	.410	.377	.303	.149	.018

TABLE 6c
AQCR 140 - SULFUR DIOXIDE
Parts Per Million

Site Code	Site Name/Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	3 Hr Max	24 Hr Max	Monthly Average
0080 064 F 05	North Johnson Lane	86	01	728	.275	.245	.238	.187	.075	.030
			02	624	.302	.252	.242	.230	.087	.025
			03	719	.367	.327	.302	.285	.087	.020
			04	715	.154	.150	.125	.107	.038	.010
			05	733	.212	.208	.192	.165	.049	.013
			06	523	.399	.268	.238	.249	.053	.015
			07	---	---	---	---	---	---	---
			08	---	---	---	---	---	---	---
			09	---	---	---	---	---	---	---
			10	---	---	---	---	---	---	---
			11	---	---	---	---	---	---	---
			12	---	---	---	---	---	---	---
		ANNUAL		4042	.399	.367	.327	.285	.087	.019

TABLE 6d
AQCR 140 - SULFUR DIOXIDE
Parts Per Million

Site Code	Site Name/Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	3 Hr Max	24 Hr Max	Monthly Average
0080 065 F 01	Lockwood Park	82	01	733	.267	.261	.257	.223	.139	.026
			02	663	.228	.227	.210	.170	.077	.034
			03	724	.260	.250	.232	.162	.075	.019
			04	593	.657	.623	.520	.600	.109	.020
			05	733	.322	.230	.200	.200	.056	.014
			06	596	.284	.227	.224	.238	.067	.015
			07	563	.287	.222	.200	.187	.080	.017
			08	716	.243	.242	.239	.200	.067	.024
			09	601	.324	.248	.205	.210	.063	.023
			10	632	.278	.257	.252	.230	.062	.024
			11	713	.235	.234	.218	.188	.059	.026
			12	739	.663	.542	.411	.483	.173	.036
		ANNUAL		8106	.663	.657	.623	.600	.173	.023
0080 065 F 01	Lockwood Park	83	01	736	.468	.323	.252	.281	.130	.033
			02	559	.562	.490	.438	.380	.104	.032
			03	738	.500	.388	.354	.344	.103	.021
			04	700	.347	.326	.233	.198	.068	.019
			05	735	.277	.183	.177	.155	.056	.021
			06	676	.442	.361	.265	.325	.116	.029
			07	731	.360	.302	.290	.233	.070	.031
			08	733	.401	.388	.369	.317	.103	.036
			09	632	.527	.460	.410	.392	.095	.035
			10	431	.332	.215	.202	.169	.062	.033
			11	712	.248	.189	.185	.172	.091	.028
			12	567	.175	.175	.174	.157	.087	.038
		ANNUAL		7950	.562	.527	.500	.392	.130	.029

TABLE 6e
AQCR 140 - SULFUR DIOXIDE
Parts Per Million

Site Code	Site Name/Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	3 Hr Max	24 Hr Max	Monthly Average
0080 065 F 01	Lockwood Park	84	01	734	.207	.182	.170	.171	.089	.042
			02	683	.214	.182	.148	.180	.068	.020
			03	701	.225	.151	.149	.146	.038	.015
			04	716	.266	.173	.170	.134	.093	.013
			05	566	.293	.253	.199	.212	.039	.014
			06	547	.219	.177	.146	.144	.046	.013
			07	---	---	---	---	---	---	---
			08	459	.322	.311	.255	.180	.066	.029
			09	702	.378	.271	.222	.197	.067	.025
			10	59	.328	.306	.212	.277	.110	.060
			11	84	.089	.056	.054	.054	.025	.017
			12	717	.550	.400	.210	.293	.067	.029
		ANNUAL		5968	.550	.400	.378	.293	.110	.023
0080 065 F 01	Lockwood Park	85	01	688	.494	.398	.326	.406	.167	.037
			02	528	.136	.129	.115	.098	.049	.020
			03	654	.176	.161	.161	.142	.051	.018
			04	561	.196	.158	.144	.117	.040	.013
			05	727	.197	.188	.186	.108	.030	.014
			06	686	.394	.246	.236	.314	.098	.020
			07	732	.332	.291	.213	.174	.074	.023
			08	226	.439	.226	.211	.275	.069	.024
			09	457	.201	.190	.177	.177	.062	.017
			10	739	.231	.221	.217	.193	.079	.019
			11	712	.299	.282	.280	.269	.104	.020
			12	734	.373	.238	.230	.222	.077	.023
		ANNUAL		7444	.494	.439	.398	.406	.167	.021

TABLE 6f
AQCR 140 - SULFUR DIOXIDE
Parts Per Million

Site Code	Site Name/Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	3 Hr Max	24 Hr Max	Monthly Average
0080 065 F 01	Lockwood Park	86	01	740	.329	.279	.270	.224	.070	.027
			02	668	.441	.243	.204	.296	.095	.021
			03	734	.302	.269	.256	.186	.064	.019
			04	711	.275	.270	.240	.211	.112	.025
			05	718	.244	.228	.224	.179	.053	.017
			06	712	.437	.400	.377	.282	.059	.023
			07	737	.373	.255	.252	.249	.068	.027
			08	638	.304	.241	.234	.229	.061	.030
			09	705	.325	.208	.197	.209	.056	.016
			10	739	.432	.380	.369	.379	.115	.034
			11	713	.341	.262	.247	.261	.069	.021
			12	733	.361	.245	.184	.204	.071	.033
		ANNUAL		8548	.441	.437	.432	.379	.115	.024

TABLE 6g
AQCR 140 - SULFUR DIOXIDE
Parts Per Million

Site Code	Site Name/Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	3 Hr Max	24 Hr Max	Monthly Average
0080 066 F 05	Coburn Road	82	01	728	.409	.392	.359	.314	.155	.052
			02	601	.342	.265	.231	.187	.098	.043
			03	630	.263	.242	.217	.240	.071	.024
			04	634	.310	.275	.220	.261	.052	.013
			05	649	.210	.115	.111	.095	.021	.007
			06	707	.150	.131	.113	.111	.035	.011
			07	733	.227	.195	.169	.135	.050	.012
			08	734	.385	.307	.270	.202	.072	.028
			09	528	.335	.275	.275	.288	.074	.026
			10	448	.331	.223	.184	.231	.072	.033
			11	151	.213	.176	.149	.127	.073	.051
			12	734	.541	.373	.360	.397	.140	.040
		ANNUAL		7277	.541	.409	.392	.397	.155	.026
0080 066 F 05	Coburn Road	83	01	739	.778	.697	.581	.650	.222	.051
			02	668	.345	.334	.275	.211	.087	.036
			03	704	.449	.357	.249	.296	.086	.017
			04	706	.263	.230	.209	.180	.050	.012
			05	733	.229	.222	.217	.140	.050	.011
			06	713	.398	.312	.207	.206	.045	.010
			07	568	.195	.192	.169	.157	.064	.022
			08	525	.333	.286	.267	.251	.076	.036
			09	709	.422	.417	.308	.315	.119	.032
			10	576	.399	.365	.362	.341	.070	.024
			11	646	.201	.199	.184	.150	.086	.038
			12	570	.321	.243	.236	.206	.108	.047
		ANNUAL		7857	.778	.697	.581	.650	.222	.027

TABLE 6h
AQCR 140 - SULFUR DIOXIDE
Parts Per Million

Site Code	Site Name/Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	3 Hr Max	24 Hr Max	Monthly Average
0080 066 F 05	Coburn Road	84	01	734	.220	.212	.208	.210	.088	.035
			02	174	.145	.126	.099	.088	.037	.014
			03	633	.310	.134	.131	.123	.038	.011
			04	712	.279	.196	.195	.201	.042	.012
			05	366	.218	.140	.129	.109	.029	.013
			06	158	.293	.198	.141	.178	.038	.020
			07	---	---	---	---	---	---	---
			08	571	.372	.268	.227	.187	.069	.030
			09	712	.362	.237	.198	.207	.073	.027
			10	85	.350	.310	.300	.300	.121	.076
			11	---	---	---	---	---	---	---
			12	464	.438	.418	.282	.224	.120	.052
		ANNUAL		4609	.438	.418	.372	.300	.121	.026
0080 066 F 05	Coburn Road	85	01	726	.996	.813	.727	.845	.202	.041
			02	567	.328	.284	.246	.263	.089	.022
			03	517	.358	.253	.247	.212	.120	.029
			04	245	.240	.208	.128	.119	.032	.009
			05	580	.262	.159	.142	.115	.031	.011
			06	683	.205	.170	.162	.149	.044	.014
			07	728	.334	.219	.204	.169	.053	.023
			08	72	.082	.079	.061	.069	.027	.016
			09	423	.177	.152	.138	.110	.034	.011
			10	704	.502	.443	.359	.408	.135	.031
			11	635	.305	.295	.288	.246	.111	.031
			12	547	.305	.290	.261	.204	.099	.033
		ANNUAL		6427	.996	.813	.727	.845	.202	.024

TABLE 6i
AQCR 140 - SULFUR DIOXIDE
Parts Per Million

Site Code	Site Name/Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	3 Hr Max	24 Hr Max	Monthly Average
0080 066 F 05	Coburn Road	86	01	739	.254	.206	.206	.222	.094	.030
			02	651	.603	.529	.270	.467	.109	.024
			03	723	.389	.148	.130	.183	.042	.014
			04	714	.314	.289	.185	.250	.055	.015
			05	730	.149	.139	.136	.096	.042	.011
			06	515	.332	.187	.171	.178	.060	.018
			07	339	.233	.180	.146	.143	.042	.019
			08	736	.489	.366	.329	.311	.092	.041
			09	551	.268	.154	.134	.138	.034	.014
			10	676	.411	.386	.338	.285	.108	.042
			11	715	.337	.320	.272	.224	.102	.033
			12	721	.394	.323	.317	.251	.097	.045
		ANNUAL		7810	.603	.529	.489	.467	.109	.026

TABLE 7
AQCR 140 - SO2 - Number of Exceedances
Parts per Million

County/City Site Code	Site Name/Location	Yr	Num Obs	Federal Prim 24-Hr 0.14	Federal Prim Annual 0.03	Federal Sec 3-Hr 0.50	Montana Std 1-Hr 0.50	Montana Std 24-Hr 0.10	Montana Std Annual 0.02
Yellowstone/Billings									
0080 064 F 05	North Johnson Lane	85	7289	1*	0	0	0	7	0
		86	4042	0	0	0	0	0	0
0080 065 F 01	Lockwood Park	85	7444	1*	0	0	0	3	1**
		86	8548	0	0	0	0	2	1
0080 066 F 05	Coburn Road	85	6427	1	0	2	4	5	1**
		86	7810	0	0	0	2	3	1**

* Average is not from midnight to midnight - not a violation

** Insufficient data recovery - not a violation

TABLE 8a
AQCR 140 - SULFATION RATE
Milligrams Sulfur Trioxide per 100 Square Centimeters per Day

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Yellowstone/Billings							
0080 001 G 02	214 Pueblo Street	84	12	.68	.35	.34	.20
		85	12	.57	.55	.45	.24
		86	11	.54	.37	.36	.27
0080 003 G 02	Bitterroot	82	12	.56	.47	.40	.28
		83	12	.53	.52	.50	.35
		84	12	.82	.49	.42	.36
		85	12	.51	.51	.47	.32
		86	12	.69	.55	.52	.41
0080 004 G 02	Johnson Lane	82	12	1.09	.82	.71	.51
		83	11	1.19	1.03	.79	.57
		84	12	1.25	1.09	.94	.70
		85	12	1.13	1.00	.92	.64
		86	10	1.23	.92	.85	.81
0080 006 G 02	Lockwood School	82	12	1.16	1.15	1.11	.61
		83	12	1.08	.99	.89	.68
		84	12	1.25	1.07	.94	.73
		85	12	.98	.87	.86	.64
		86	12	1.03	.96	.96	.81
0080 007 G 01	KGHL Station	82	12	.96	.55	.53	.36
		83	12	.85	.55	.45	.37
		84	11	.81	.48	.46	.28
		85	12	.69	.58	.44	.30
		86	12	.61	.44	.44	.32
0080 008 G 01	City Hall	82	12	.47	.38	.31	.21
		83	12	.69	.45	.39	.36
		84	12	.56	.50	.39	.24
		85	12	.61	.55	.49	.30
		86	12	.45	.42	.36	.30

TABLE 8b
AQCR 140 - SULFATION RATE
Milligrams Sulfur Trioxide per 100 Square Centimeters per Day

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Yellowstone/Billings							
0080 010 G 02	Garden Avenue	82	12	.35	.33	.30	.20
		83	12	.55	.27	.25	.21
		84	12	.36	.28	.19	.13
		85	12	.51	.28	.27	.21
		86	12	.39	.36	.33	.21
0080 011 G 02	33rd Street & 2nd Avenue North	82	12	.37	.28	.21	.15
		83	12	.51	.32	.28	.19
		84	12	.45	.36	.26	.17
		85	11	.54	.45	.26	.22
		86	11	.43	.41	.27	.23
0080 014 G 02	Mountain View Boulevard	82	12	.31	.30	.23	.16
		83	12	.58	.41	.24	.19
		84	12	.56	.45	.29	.20
		85	12	.50	.46	.37	.22
		86	11	.45	.38	.37	.23
0080 017 G 02	Minnesota Avenue	82	12	.82	.71	.63	.45
		83	12	.88	.67	.66	.46
		84	12	.86	.79	.78	.47
		85	12	.78	.73	.66	.45
		86	12	.80	.73	.67	.52
0080 018 G 02	5th Street & South 28th	82	11	.67	.56	.48	.35
		83	12	.69	.50	.36	.32
		84	12	.55	.51	.45	.30
		85	12	.66	.56	.39	.31
		86	12	.59	.53	.47	.36
0080 019 G 02	South 27th & 11th Avenue South	82	10	1.05	.94	.53	.51
		83	12	1.10	.69	.67	.50
		84	12	.88	.71	.60	.45
		85	12	.92	.85	.82	.54
		86	12	.83	.76	.72	.54

TABLE 8c
AQCR 140 - SULFATION RATE
Milligrams Sulfur Trioxide per 100 Square Centimeters per Day

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Yellowstone/Billings							
0080 021 G 02	East of Conoco	82	11	1.32	1.09	.61	.59
		83	12	.99	.86	.67	.53
		84	12	1.20	.97	.73	.57
		85	11	.96	.93	.81	.57
		86	12	.83	.82	.81	.64
0080 022 G 02	Two Moon Park	82	12	1.34	1.17	1.09	.67
		83	12	1.43	1.22	.91	.74
		84	12	1.57	1.23	.86	.73
		85	12	1.30	1.23	.94	.69
		86	12	1.09	1.08	1.04	.82
0080 025 G 02	State Street & 3rd South	84	12	.79	.60	.48	.37
		85	12	.90	.72	.55	.40
		86	12	.72	.62	.54	.45
0080 027 G 02	Newman School	82	11	.53	.48	.47	.26
		83	11	.68	.49	.44	.32
		84	12	.71	.56	.31	.25
		85	12	.76	.55	.33	.28
		86	12	.64	.45	.42	.33
0080 028 G 02	Bench School	82	12	.36	.33	.26	.18
		83	12	.57	.38	.36	.24
		84	12	.69	.49	.44	.28
		85	12	.55	.49	.44	.28
		86	12	.54	.47	.41	.30
0080 032 G 02	Klenck Lane	82	12	1.27	1.22	1.19	.64
		83	12	1.28	.99	.95	.63
		84	12	1.29	1.08	.88	.64
		85	12	1.39	.98	.96	.66
		86	12	1.12	1.04	.98	.77

TABLE 8d
AQCR 140 - SULFATION RATE
Milligrams Sulfur Trioxide per 100 Square Centimeters per Day

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Yellowstone/Billings							
0080 034 G 02	Piccolo and Frontage Road	82	12	1.58	1.38	1.34	1.14
		83	12	1.54	1.41	1.08	.98
		84	12	1.79	1.45	1.33	1.02
		85	12	1.38	1.29	1.19	.99
		86	12	1.68	1.51	1.38	1.22
0080 037 G 02	Johnson and Lockwood	82	12	1.46	1.41	1.40	.79
		83	11	1.90	1.71	1.21	.94
		84	12	2.43	1.38	1.04	.96
		85	10	1.65	1.48	1.41	.93
		86	12	1.74	1.70	1.60	1.04
0080 038 G 02	Johnson Road North	82	12	1.46	1.38	1.15	.83
		83	12	1.60	1.58	1.39	.91
		84	12	2.43	1.44	1.41	1.12
		85	12	1.80	1.68	1.51	.95
		86	11	2.02	1.95	1.85	1.28
0080 061 G 02	Metra Parking Lot	84	11	.75	.62	.59	.38
		85	12	.85	.65	.60	.41
		86	12	.80	.61	.59	.49
0080 065 G 02	Lockwood Park	84	12	1.37	.96	.89	.73
		85	12	.87	.84	.81	.66
		86	11	1.17	1.11	1.06	.92
0080 066 G 02	Coburn Road	84	12	2.15	1.62	1.55	1.02
		85	12	1.89	1.70	1.61	1.06
		86	12	1.87	1.57	1.49	1.17
0080 067 G 02	Sandstone School	84	8	.49	.32	.24	.18
		85	12	.47	.29	.22	.14
		86	12	.44	.40	.34	.18

TABLE 8e
AQCR 140 - SULFATION RATE
Milligrams Sulfur Trioxide per 100 Square Centimeters per Day

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Yellowstone/Billings							
0080 072 G 01	Grand Avenue School	82	12	.59	.39	.28	.21
		83	12	.62	.25	.22	.36
		84	12	.61	.40	.35	.21
		85	12	.61	.54	.43	.25
		86	12	.59	.50	.41	.31
Yellowstone/Laurel							
0840 001 G 02	Laurel Junior High	82	10	.43	.17	.09	.10
		83	12	.50	.16	.16	.11
		84	12	.23	.21	.20	.08
		85	12	.38	.37	.19	.13
		86	12	.37	.20	.16	.10
0840 003 G 02	Roadhouse Road	82	12	1.03	.81	.65	.43
		83	12	1.05	1.04	.73	.48
		84	12	1.49	.96	.86	.55
		85	12	1.50	1.15	1.02	.64
		86	12	1.59	1.49	1.14	.82
0840 004 G 02	City Sewage Treatment Plant	82	12	.69	.67	.61	.48
		83	8	.88	.64	.54	.51
		84	12	.64	.60	.58	.48
		85	11	.78	.67	.51	.48
		86	12	1.08	1.05	.88	.72
0840 005 G 02	Laurel Water Plant	82	12	.64	.62	.61	.42
		83	12	.66	.62	.59	.43
		84	12	.67	.66	.65	.49
		85	12	.78	.70	.60	.49
		86	12	1.39	.83	.79	.70

TABLE 8f
AQCR 140 - SULFATION RATE
Milligrams Sulfur Trioxide per 100 Square Centimeters per Day

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Yellowstone/Laurel							
0840 006 G 02	West Laurel Church	82	10	.43	.22	.17	.13
		83	12	.52	.20	.20	.17
		84	12	.27	.26	.22	.14
		85	10	.40	.23	.22	.16
		86	11	.36	.35	.28	.17
0840 007 G 02	A & W Root Beer	84	12	.29	.26	.23	.11
		85	12	.44	.28	.28	.17
		86	11	.44	.28	.21	.14
0840 008 G 02	East of Laurel	82	12	1.35	1.04	.92	.65
		83	12	1.76	1.25	.86	.72
		84	12	2.42	1.29	1.14	.89
		85	12	1.85	1.56	1.43	.91
		86	12	2.10	1.83	1.82	1.17
0840 009 G 02	Farm East of CENEX	82	10	1.51	1.16	.99	.77
		83	11	2.00	1.60	1.37	.90
		84	12	2.74	1.46	1.06	1.03
		85	12	1.67	1.51	1.28	.96
		86	12	2.11	2.08	1.94	1.43
0840 010 G 02	Root Beer Stand	84	12	1.52	.93	.62	.52
		85	12	1.31	1.02	.76	.54
		86	12	1.30	.98	.94	.62
0840 013 G 02	West Coop	82	9	.26	.24	.18	.15
		83	11	.46	.32	.23	.19
		84	12	.31	.24	.24	.15
		85	12	.39	.38	.37	.23
		86	12	.59	.43	.39	.27

TABLE 9
AQCR 140 - RESPIRABLE PARTICULATES (PM10)
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
0080 072 G 01	Grand Avenue School	86	25	84	79	70	33.6

FIGURE 2a

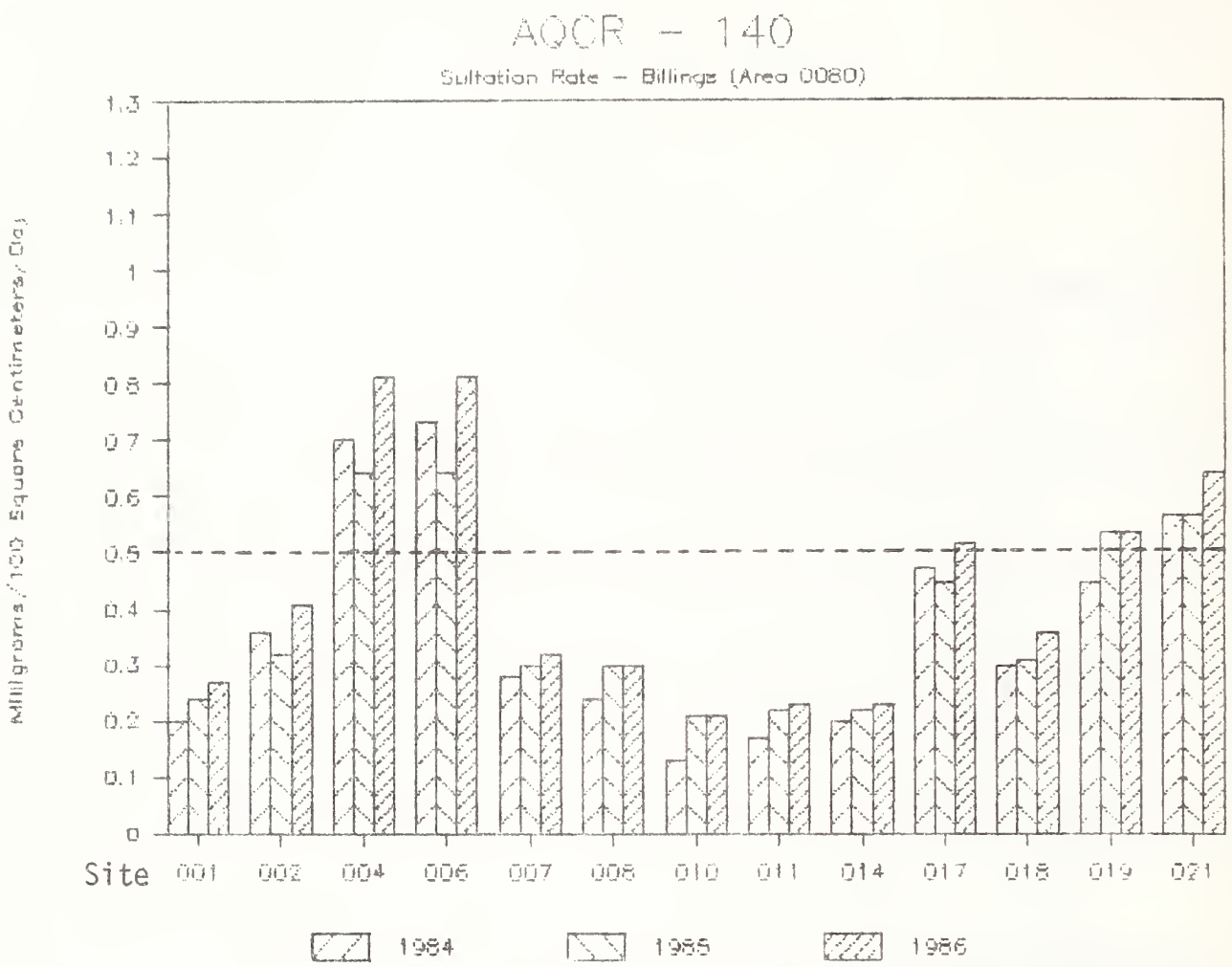


FIGURE 2b

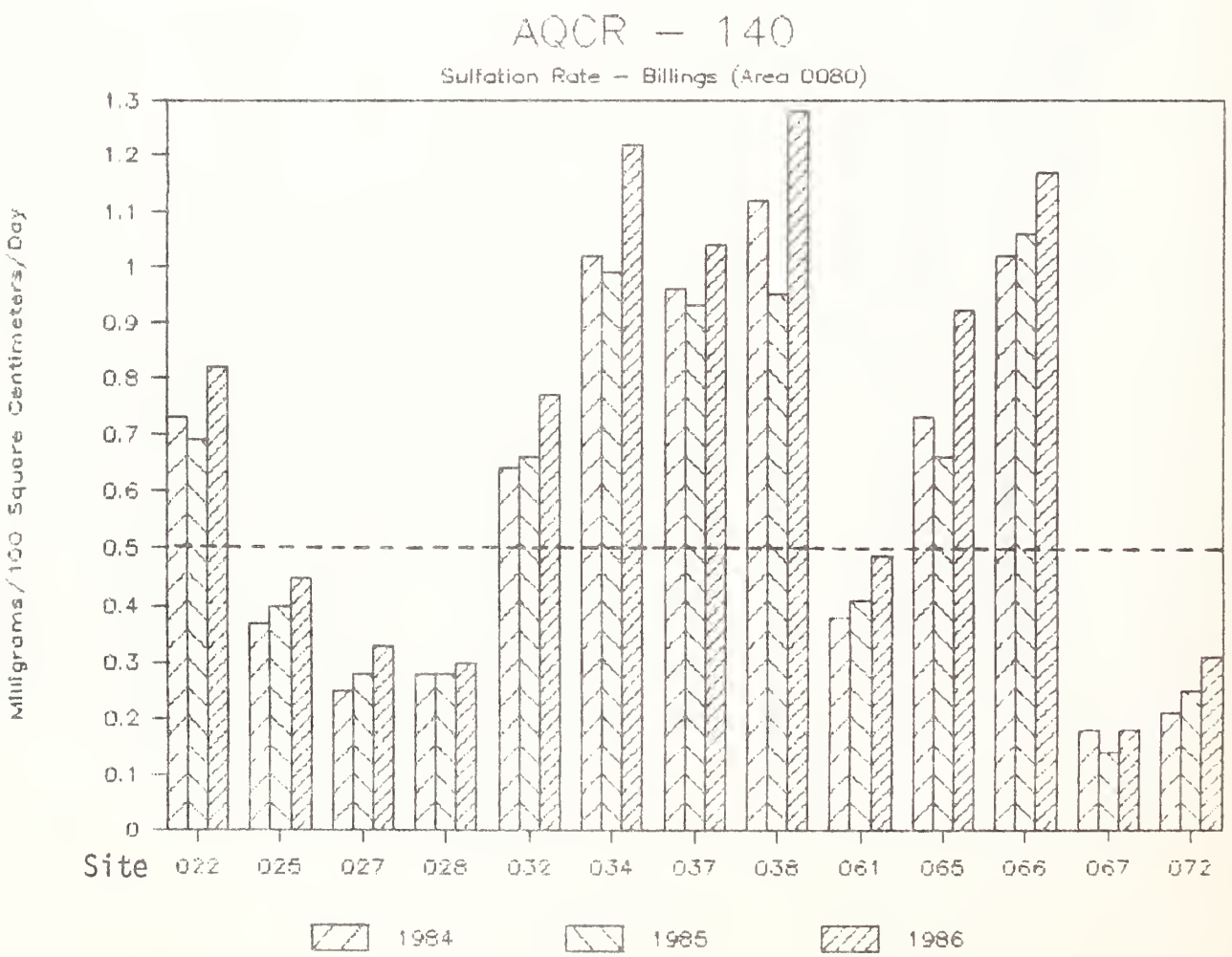
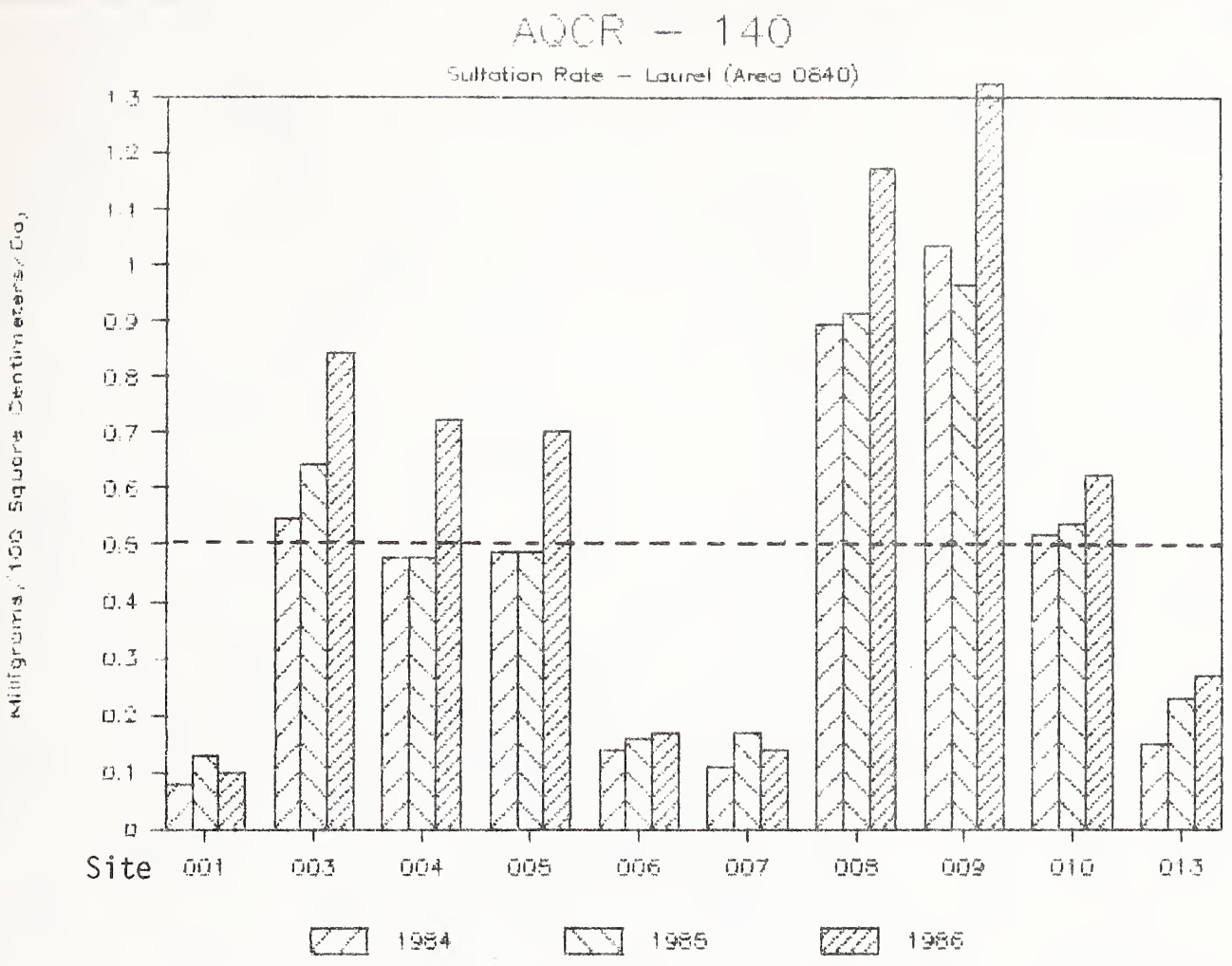


FIGURE 3


AQCR - 140
Sulfation Rate - Laurel (Area 0840)
Milligrams/100 Square Centimeters/Day
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Site
001
003
004
005
006
007
008
009
010
013
1984
1985
1986

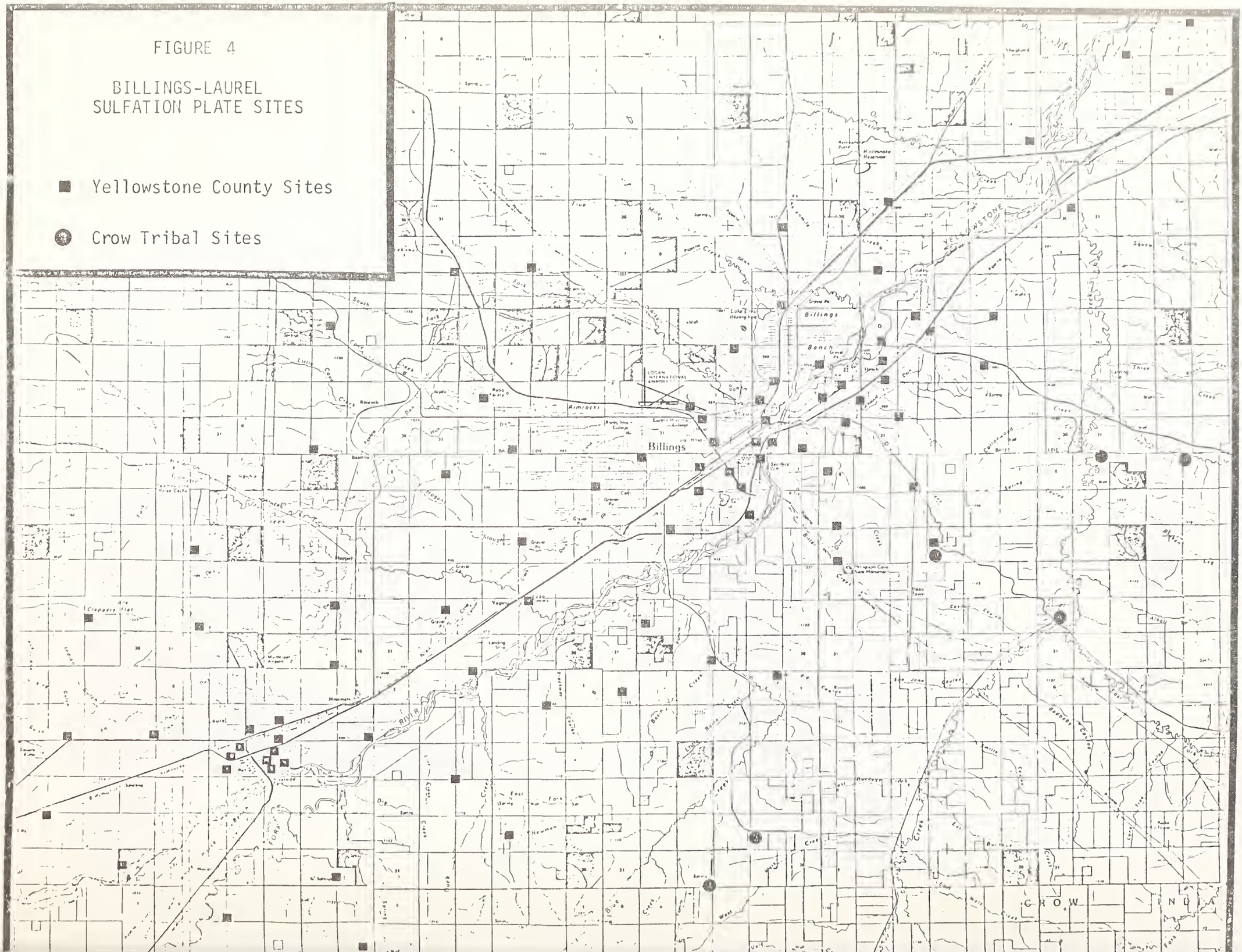
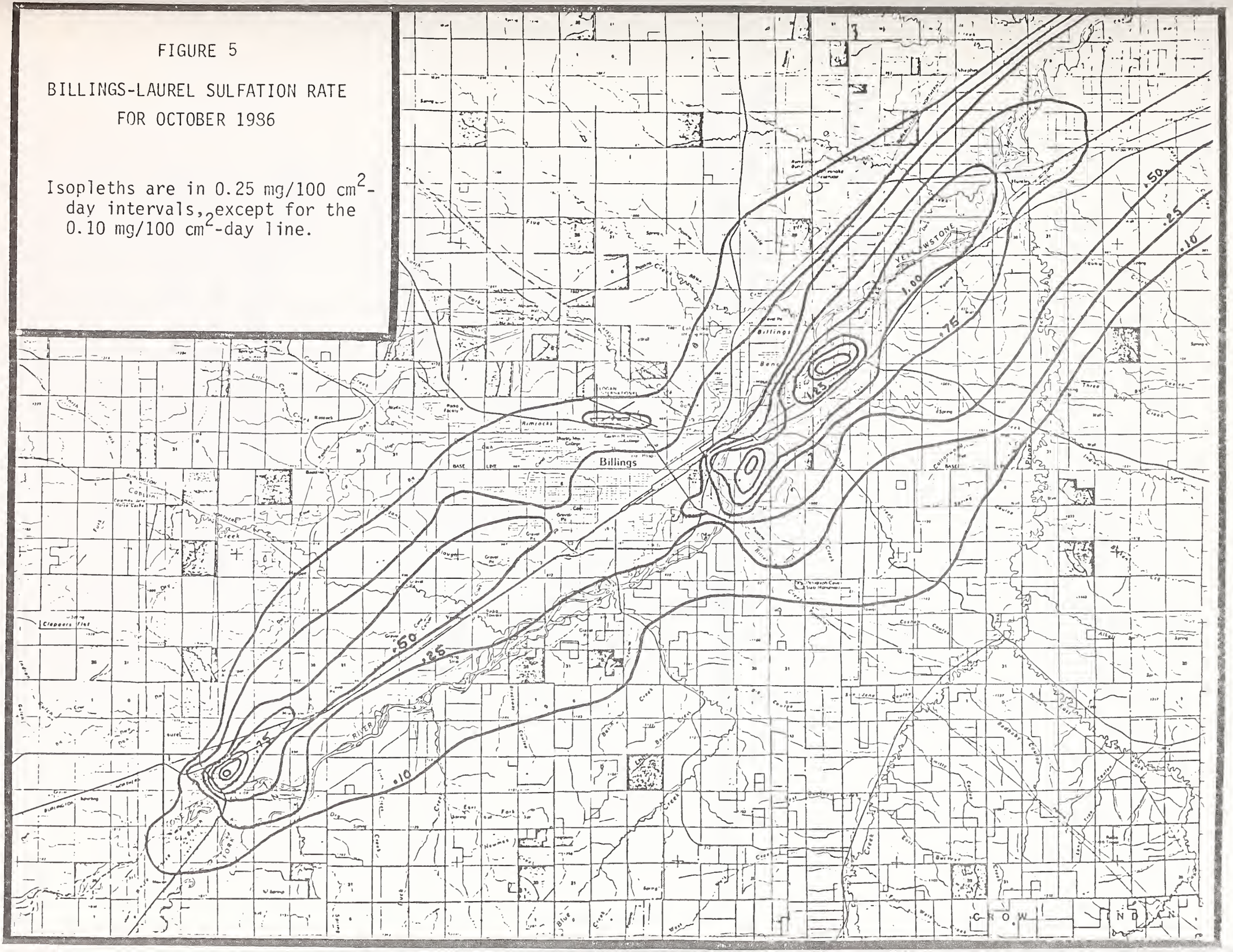


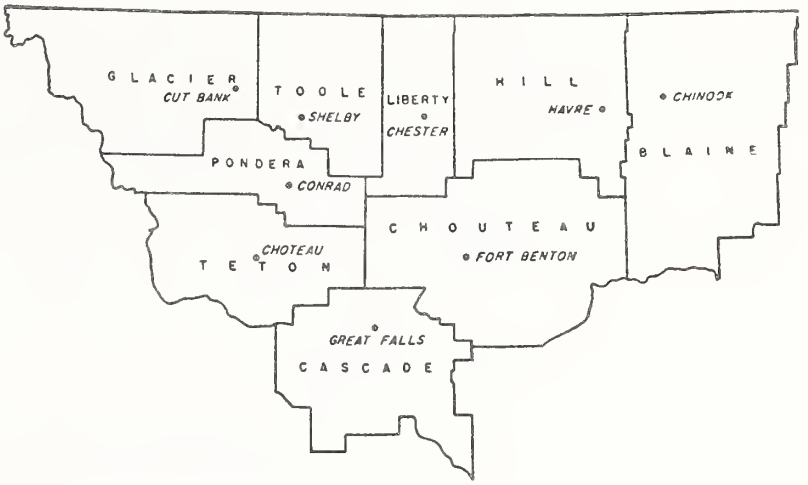
FIGURE 4
BILLINGS-LAUREL
SULFATION PLATE SITES
Yellowstone County Sites
Crow Tribal Sites
Billings
Billings
Bench
Laurel
CROW

FIGURE 5

BILLINGS-LAUREL SULFATION RATE
FOR OCTOBER 1986

Isopleths are in 0.25 mg/100 cm^2-day intervals, except for the 0.10 mg/100 cm^2-day line.





AQCR 141

North central Montana

LOCATION AND PHYSICAL FEATURES

AQCR 141 is located in north central Montana. Glaciated plain is the main physical feature. There are some foothills and mountainous areas along the western edge (Continental Divide) and south of Havre (Bearpaw Mountains).

The Missouri River flows from west to east in the southern portion of the region. Several other tributary rivers of the Missouri also flow from west to east in the region.

POPULATION

The 1986 estimated population of AQCR 141 is 142,400 or 17.3 percent of the state population. Over half of the people in this region live in Cascade County (Great Falls).

POLLUTION SOURCES

Pollution sources and types of pollutants are listed for each county in the region. A final category lists the types of sources that would be expected in all counties in the region. The sources by county are as follows:

Cascade County

- Several grain processing and feed mills (particulates)
- Oil refinery (particulates, SO_2, NOx, CO, VOC)
- Vermiculite manufacturing (particulates)

Glacier County

- Two gas sweetening plants (SO_2, NOx)

Toole County

- Gas sweetening plant (SO_2, NOx)

All Counties

- Asphalt plants (particulates)
- Gravel crushers (particulates)
- Home heating devices (particulates, CO)
- Automobiles (CO, NOx, re-entrained particulates)
- Agricultural activities (particulates)
- Wind erosion (particulates)

MONITORING SITE DESCRIPTIONS

The majority of monitoring in this region was done in the Great Falls area. In addition, sulfation plates were set out in Toole County

to monitor the concentrations of sulfur oxides from a gas sweetening plant. Table 10 lists the monitoring site descriptions. This includes site codes, site name, supporting agency, station type, project description, city name and county name, and the parameters or pollutants monitored in 1986.

DATA SUMMARY

Total Suspended Particulates

TSP was monitored at three sites in this region in 1986. One of the sites was collocated. The maximum 24-hour observation was 232 $\mu g/m^3$ at the Black Eagle Post Office site. The highest annual geometric average was 61.1 $\mu g/m^3$ and the highest annual arithmetic average was 72.7 $\mu g/m^3$ at the Fire Station #1 site. Table 11 summarizes the TSP data for this region and Table 12 shows the number of exceedances for TSP. Figure 6 shows a three-year comparison of the annual averages for the TSP sites in the region.

Carbon Monoxide

Carbon monoxide was monitored at one location (Pardis Clinic) in this region. The maximum eight hour observation was 10.0 ppm. One reading of 23.7 ppm in December exceeded the Montana 1-hour standard but is not classed as a violation until it is exceeded twice. The Montana and federal 8-hour standard of 9 ppm was violated twice during 1986. Table 13 summarizes the CO data for this region and Table 14 shows the number of exceedances of the CO standards.

Sulfation Rate

Sulfation rate was measured at one site in this region to monitor sulfur levels around oil/gas development (Anabelle Sheets Residence).

One sulfation plate was analyzed with a reading of 0.04 mg SO_3/100 cm^2/day. There is no standard for sulfation rate, but levels above 0.5 mg SO_3/100 cm^2/day indicate possible trouble spots.

Respirable Particulates (PM-10)

Particulate matter less than 10 microns (PM-10) was monitored at one site in Cascade County. The maximum 24-hour observation was 73 $\mu g/m^3$; the annual average for 1986 was 30.1 $\mu g/m^3$. Table 15 summarizes the PM-10 data for this region.

TABLE 10

AQCR 141 - MONITORING SITE DESCRIPTIONS

AREA/SITE CODE	SITE NAME/ADDRESS SUPPORTING AGENCY	STATION TYPE PROJECT DESCRIPTION	CITY COUNTY	PARAMETER
0660 009 G 01	FIRE STATION #1 - 9TH ST & 1ST AVE SOUTH CASCADE COUNTY HEALTH DEPARTMENT	CITY CENTER-RESIDENTIAL POPULATION ORIENTED	GREAT FALLS CASCADE	TSP
0660 017 G 01	DOWNTOWN (WEST) - 301 2ND AVE N CASCADE COUNTY HEALTH DEPARTMENT	CITY CENTER-COMMERCIAL POPULATION ORIENTED	GREAT FALLS CASCADE	TSP, PM10
0660 017 G 07	DOWNTOWN (EAST) - 301 2ND AVE N CASCADE COUNTY HEALTH DEPARTMENT	CITY CENTER-COMMERCIAL QA-COLOCATED SAMPLER	GREAT FALLS CASCADE	TSP
0660 019 G 01	BLACK EAGLE PO - 1321 SMELTER AVE CASCADE COUNTY HEALTH DEPARTMENT	CITY CENTER-COMMERCIAL POPULATION ORIENTED	GREAT FALLS CASCADE	TSP
0660 023 G 02	PARDIS CLINIC - 826 10TH AVE SOUTH CASCADE COUNTY HEALTH DEPARTMENT	CITY CENTER-COMMERCIAL SOURCE ORIENTED	GREAT FALLS CASCADE	CO, WIND
1380 008 F 05	ANABELLE SHEETS RESIDENCE, HIWAY 91 MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL SPECIAL STUDIES	DILMONT TOOLE	SULFATION RATE

PARAMETER ABBREVIATIONS

TSP	TOTAL SUSPENDED PARTICULATES
PM10	PARTICULATE MATTER 10 (SIZE 10 MICRONS AND UNDER)
PM15	PARTICULATE MATTER 15 (SIZE 15 MICRONS AND UNDER)
DICHOT	DICHOTINOUS SAMPLER (FINE, COARSE, AND TOTAL PARTICULATES)
CO	CARBON MONOXIDE
SO2	SULFUR DIOXIDE
WIND	WIND SPEED, WIND DIRECTION AND TEMPERATURE

TABLE 11
AQCR 141 - TOTAL SUSPENDED PARTICULATES
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean	Geom Mean
Cascade/Great Falls								
0660 009 G 01	Fire Station #1	82	52	204	179	158	78.5	67.1
		83	57	163	112	105	55.2	49.6
		84	59	175	174	165	71.9	63.3
		85	55	264	225	208	78.7	65.8
		86	58	204	204	201	72.7	61.1
0660 017 G 01	Downtown	82	50	107	106	105	54.2	48.7
		83	57	108	105	87	46.7	42.2
		84	51	120	93	89	50.9	45.8
		85	59	169	125	121	52.6	45.6
		86	58	167	149	135	54.7	45.8
0660 017 G 07	Downtown - Collocated	82	55	104	104	93	52.5	47.4
		83	60	110	89	88	47.0	42.4
		84	61	116	115	96	51.0	45.3
		85	60	172	122	116	50.3	43.1
		86	60	171	135	132	53.8	44.6
0660 019 G 01	Black Eagle PO	82	60	216	144	140	73.3	65.5
		83	58	201	171	128	63.4	55.6
		84	59	175	134	130	63.9	55.9
		85	59	225	204	150	64.3	52.6
		86	60	232	171	170	70.3	59.3

TABLE 12
AQCR 141 - TSP - Number of Exceedances
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Federal Daily 260	Prim Annual G 75	Federal Daily 150	Sec Annual G 60	Montana Daily 200	Std Annual A 75
Cascade/Great Falls									
0660 009 G 01	Fire Station #1	85	55	1	0	5	1	3	1
		86	58	0	0	5	1	3	0
0660 017 G 01	Downtown	85	59	0	0	1	0	0	0
		86	58	0	0	1	0	0	0
0660 019 G 01	Black Eagle PO	85	59	0	0	3	0	2	0
		86	60	0	0	4	0	1	0

FIGURE 6

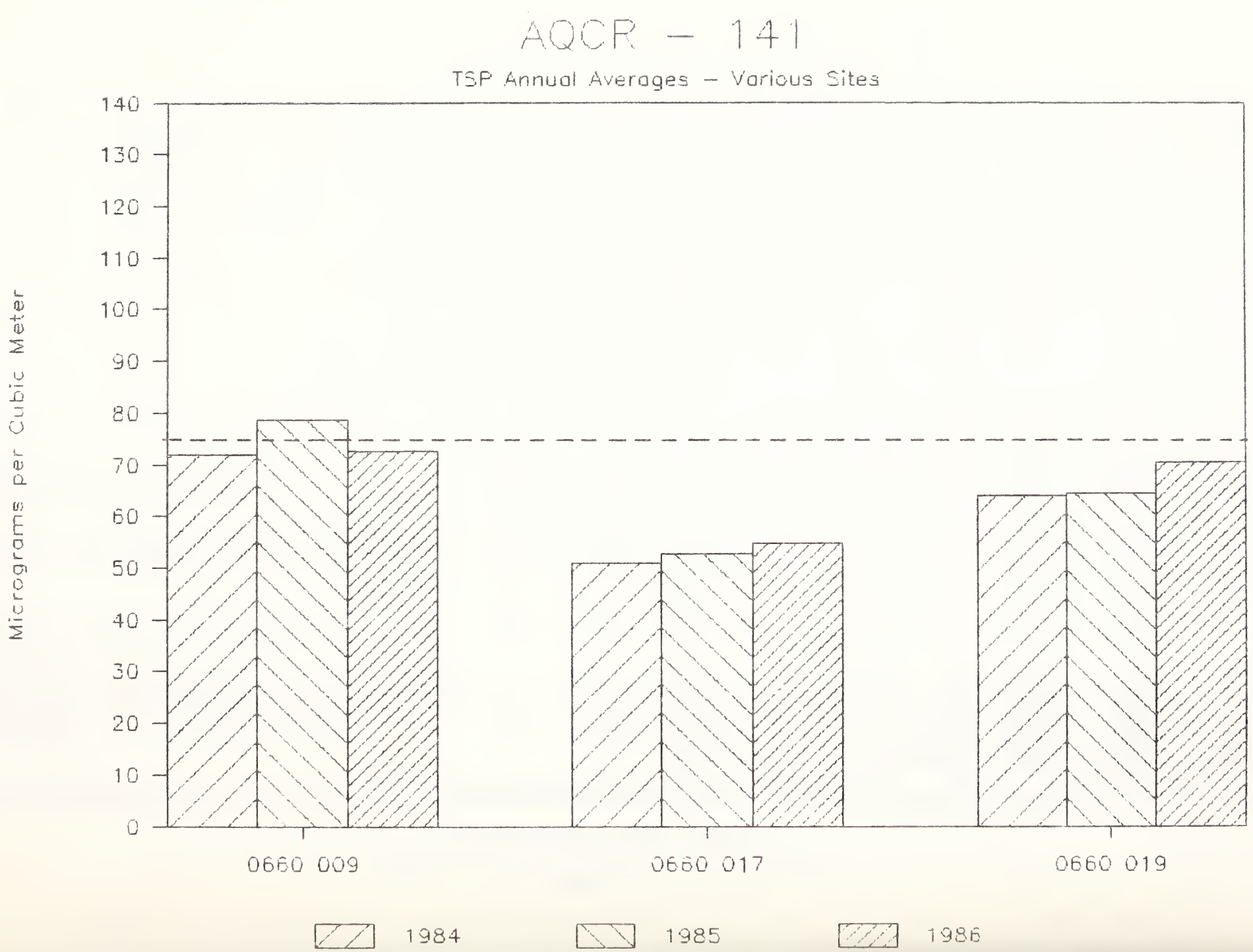

AQCR – 141
TSP Annual Averages – Various Sites
Micrograms per Cubic Meter
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0660 009
0660 017
0660 019
1984
1985
1986

TABLE 13a
AQCR 141 - CARBON MONOXIDE
Parts Per Million

County/City Site Code	Site Name/Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	8 Hr Max	Monthly Average
0660 023 G 02	Pardis Clinic	83	01	---	---	---	---	---	---
			02	---	---	---	---	---	---
			03	---	---	---	---	---	---
			04	---	---	---	---	---	---
			05	---	---	---	---	---	---
			06	---	---	---	---	---	---
			07	---	---	---	---	---	---
			08	---	---	---	---	---	---
			09	---	---	---	---	---	---
			10	---	---	---	---	---	---
			11	500	9.0	8.7	8.3	10.3	1.6
			12	742	20.3	16.9	16.6	6.7	2.6
		ANNUAL		1242	20.3	16.9	16.6	10.3	---
0660 023 G 02	Pardis Clinic	84	01	691	9.4	7.9	7.8	5.5	1.1
			02	653	18.8	18.0	17.0	14.5	1.1
			03	738	8.7	7.0	6.9	6.6	1.8
			04	626	5.6	5.5	5.4	4.6	1.3
			05	740	6.7	5.0	3.8	3.1	0.8
			06	594	9.2	7.9	5.9	4.0	1.0
			07	736	6.9	6.4	6.3	4.4	1.3
			08	680	10.0	9.0	6.6	5.8	1.6
			09	554	8.8	6.2	5.6	4.6	1.4
			10	736	8.8	8.3	7.4	4.6	1.4
			11	716	10.6	9.0	9.0	6.3	1.1
			12	361	12.7	12.5	12.3	8.0	2.2
		ANNUAL		7825	18.8	18.0	17.0	14.5	---

TABLE 13b
AQCR 141 - CARBON MONOXIDE
Parts Per Million

County/City Site Code	Site Name/Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	8 Hr Max	Monthly Average
0660 023 G 02	Pardis Clinic	85	01	673	10.8	10.7	10.0	8.1	2.3
			02	587	11.1	9.2	6.7	5.3	1.4
			03	738	8.0	7.4	6.9	6.1	2.1
			04	714	6.3	5.8	5.8	4.3	1.4
			05	643	6.1	5.7	5.3	3.7	1.2
			06	716	7.8	5.2	4.9	4.1	1.2
			07	739	6.0	6.0	5.7	3.5	1.6
			08	512	8.5	6.4	6.2	4.7	1.4
			09	713	8.8	7.2	6.6	5.6	1.3
			10	738	10.8	7.1	6.7	4.4	1.0
			11	712	7.8	6.7	6.4	5.2	1.5
			12	331	8.3	7.7	6.7	4.9	1.1
		ANNUAL		7817	11.1	10.8	10.8	8.1	---
0660 023 G 02	Pardis Clinic	86	01	740	17.1	15.0	12.2	8.7	1.5
			02	667	10.2	8.8	8.8	6.5	2.1
			03	739	11.0	8.0	7.8	6.3	1.4
			04	716	5.8	5.0	4.7	3.6	1.3
			05	737	6.5	5.8	5.4	4.5	1.3
			06	716	5.4	4.9	4.8	3.6	1.0
			07	739	6.8	5.2	4.7	2.8	1.0
			08	740	5.5	5.3	4.9	3.7	1.2
			09	692	7.3	6.2	5.9	5.7	1.3
			10	739	13.3	13.1	12.3	8.0	2.0
			11	714	20.6	12.6	9.8	10.0	1.4
			12	739	23.7	18.5	16.3	9.3	1.4
		ANNUAL		8678	23.7	18.5	16.3	10.0	---

TABLE 14
AQCR 141 - CO - Number of Exceedances
Parts per Million

County/City Site Code	Site Name/Location	Yr	Num Obs	Federal Prim 1-Hr 35	Federal Prim 8-Hr 9	Montana Std 1-Hr 23	Montana Std 8-Hr 9
Cascade/Great Falls							
0660 023 G 02	Pardis Clinic	85	7817	0	0	0	0
		86	8678	0	2	1	2

TABLE 15
AQCR 141 - RESPIRABLE PARTICULATES (PM10)
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Cascade/Great Falls							
0660 017 G 01	Downtown	85	10	31	18	16	13.9
		86	56	73	71	63	30.1

AQCR 142

Southwestern Montana

LOCATION AND PHYSICAL FEATURES

AQCR 142 is located in the southwest corner of the state. The Continental Divide borders the southern edge of the region and then cuts up through the northern portion. The region contains several distinct mountain ranges separated by fairly wide valleys. Tributaries for the Missouri, Clark Fork and Yellowstone Rivers have their beginnings in this area.

POPULATION

The 1986 estimated population of AQCR 142 is 189,300 or 23.1 percent of the state population. The main population centers in the region are in Lewis & Clark County (Helena), Gallatin County (Bozeman), and Silver Bow County (Butte).

POLLUTION SOURCES

Pollution sources and types of pollutants are listed for each county in the region. A final category lists the types of sources that would be expected in all counties in the region. The sources by county are as follows:

Beaverhead County

Sawmill (particulates)

Talc production (particulates)

Broadwater County

Sawmill (particulates)

Lime production (particulates)

Gallatin County

Cement production (particulates)

Talc production (particulates)

Sawmill (particulates)

Granite County

Sawmill (particulates)

Jefferson County

Cement production (particulates)

Gold mining (particulates)

Lewis & Clark County

Primary lead smelter (particulates, SO_2, lead)

Paint pigment manufacturing (particulates, SO_2, VOC, metals)

Madison County

Talc mining (particulates)

Park County

Solid waste incinerator (particulates)

Several sawmills (particulates, CO)

Powell County

Phosphate mining (particulates)

Sawmill (particulates)

Silver Bow County

Elemental phosphorus manufacturing (particulates, fluoride)

Open pit copper mine (particulates)

All Counties

Asphalt plants (particulates)

Gravel crushers (particulates)

Home heating devices (particulates, CO)

Automobiles (CO, NOx, re-entrained particulates)

Agricultural activity (particulates)

Wind erosion (particulates)

MONITORING SITE DESCRIPTIONS

A number of monitoring sites were operating in this region during 1986. Table 16 lists the monitoring site descriptions. This includes site codes, site name, supporting agency, station type, project description, city name and county name, and the parameters or pollutants measured in 1986.

DATA SUMMARY

Total Suspended Particulates

TSP was monitored at fourteen sites in this region. One of the sites was collocated. The maximum 24-hour observation was 362 $\mu g/m^3$ at the Cogswell Building site in Helena and the second maximum was 287 $\mu g/m^3$ at the Greeley School site in Butte. The highest annual geometric average was 67.2 $\mu g/m^3$ at the Greeley School site. Two sites had violations of the federal primary 24-hour standard: the Greeley School site in Butte and the Cogswell Building site in Helena. There were no violations of the federal annual primary standard. Six sites had violations of the Montana 24-hour standard and one site had a violation of the Montana annual standard: Greeley School. Table 17 summarizes the TSP data for this region and Table 18 shows the number of exceedances. Figure 7 shows a three-year comparison of the annual averages for the TSP sites in this region.

Arsenic

Arsenic was analyzed from hi-vol filters at two sites in this region. The maximum 24-hour observation was 0.611 $\mu g/m^3$ at the Hiway Junction site near Anaconda. There is no air pollution standard for arsenic; however, the levels are elevated above background and continue to show an impact from the mining/smelting industries. Table 19 summarizes the arsenic data for this region.

Copper

Copper was analyzed from hi-vol filters at one site in this region. The maximum 24-hour observation was 70.72 $\mu g/m^3$ at the Firehall site in East Helena. The highest annual average was 7.98 $\mu g/m^3$ (at Firehall)

and represents about 13 percent by weight of the particulate concentration. There is no air pollution standard for copper. Table 20 summarizes the copper data for this region.

Lead

Lead was analyzed from hi-vol filters at three sites in the East Helena area as a continuing effort to monitor the effects of a primary lead smelter. One of the sites was collocated. The maximum 24-hour observation of 19.49 $\mu g/m^3$ and the highest annual average of 3.06 $\mu g/m^3$ occurred at the Firehall site. The annual average represents about 5 percent by weight of the particulate concentration. The highest quarterly average was 5.15 $\mu g/m^3$, also at the Firehall site. Lead concentrations at the three sites violated the federal calendar quarter standard nine out of twelve quarters. Although most of the quarterly averages are above the standard of 1.5 $\mu g/m^3$, there have been some downward trends due to control measures instituted at the smelter. Table 21 summarizes the daily lead data for this region; Table 22 summarizes the quarterly lead data; and Table 23 shows the number of exceedances of the lead standards. Figures 8 through 10 show a three-year comparison, by quarter, of the three lead monitoring sites.

Zinc

Zinc was analyzed from hi-vol filters at one site in this region. The maximum 24-hour observation was 9.99 $\mu g/m^3$ at the Firehall site in East Helena. There is no air pollution standard for zinc. Table 24 summarizes the zinc data for this region.

Respirable Particulates (PM-10)

Particulate matter less than 10 microns (PM-10) was monitored at five sites in this region in 1985. One of the sites was collocated. The maximum 24-hour observation was 213 $\mu g/m^3$ at the Greeley School site in Butte. PM-10 gives an indication of the respirable portion of TSP concentrations. Table 25 summarizes the PM-10 data for this region.

TABLE 16a

AQCR 142 - MONITORING SITE DESCRIPTIONS

AREA/SITE CODE	SITE NAME/ADDRESS SUPPORTING AGENCY	STATION TYPE PROJECT DESCRIPTION	CITY COUNTY	PARAMETER
0020 007 F 01	LINCOLN SCHOOL, CEDAR STREET MONTANA AIR QUALITY BUREAU	SUBURBAN-RESIDENTIAL POPULATION ORIENTED	ANACONDA DEER LODGE	TSP, ARSENIC
0120 002 F 01	EAST MAIN CITY BUILDING MONTANA AIR QUALITY BUREAU	CITY CENTER-COMMERCIAL POPULATION ORIENTED	BOZEMAN GALLATIN	TSP, PM10
0120 007 F 01	CHRISTIE FIELDS, 211 MASON STREET MONTANA AIR QUALITY BUREAU	SUBURBAN-RESIDENTIAL POPULATION ORIENTED	BOZEMAN GALLATIN	TSP
0160 005 F 01	GREELEY SCHOOL #1, SILVER BOW BLVD MONTANA AIR QUALITY BUREAU	CITY CENTER-RESIDENTIAL POPULATION ORIENTED	BUTTE SILVER BOW	TSP, PM10
0380 001 F 01	POWELL COUNTY COURTHOUSE, MISSOURI STREET MONTANA AIR QUALITY BUREAU	CITY CENTER-COMMERCIAL POPULATION ORIENTED	DEER LODGE POWELL	TSP
0400 004 F 02	HIWAY JUNCTION, EAST OF ANACONDA MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL SOURCE ORIENTED	DEER LODGE	TSP, ARSENIC
0420 001 F 01	BEAVERHEAD CO COURTHOUSE ROOF, IENDOY ST MONTANA AIR QUALITY BUREAU	CITY CENTER-COMMERCIAL POPULATION ORIENTED	DILLON BEAVERHEAD	TSP
0720 001 F 01	COGSWELL BLDG #1 - LOCKEY AV & ROBERTS ST MONTANA AIR QUALITY BUREAU	CITY CENTER-RESIDENTIAL POPULATION ORIENTED	HELENA LEWIS & CLARK	TSP, PM10
0720 001 F 07	COGSWELL BLDG, COLOCATED HIVOL MONTANA AIR QUALITY BUREAU	CITY CENTER-RESIDENTIAL QA-COLOCATED SAMPLER	HELENA LEWIS & CLARK	PM10
0720 013 G 05	CAPITAL COURTS - 1013 DEARBORN AVE MONTANA AIR QUALITY BUREAU	SUBURBAN-COMMERCIAL SPECIAL STUDIES	HELENA LEWIS & CLARK	TSP
0760 905 F 05	MONTANA CITY SCHOOL MONTANA AIR QUALITY BUREAU	CITY CENTER-RESIDENTIAL SPECIAL STUDIES	MONTANA CITY JEFFERSON	TSP
0860 009 F 01	1065 PHILLIPS LANE MONTANA AIR QUALITY BUREAU	SUBURBAN-RESIDENTIAL POPULATION ORIENTED	HELENA LEWIS & CLARK	PM10
0860 714 F 02	FIREHALL - 2 EAST PACIFIC ST MONTANA AIR QUALITY BUREAU	CITY CENTER-RESIDENTIAL SOURCE ORIENTED	EAST HELENA LEWIS & CLARK	TSP, COPPER, LEAD, ZINC
0860 719 F 02	HADFIELD - 101 WEST MAIN MONTANA AIR QUALITY BUREAU	SUBURBAN-INDUSTRIAL SOURCE ORIENTED	EAST HELENA LEWIS & CLARK	TSP, LEAD
0860 719 F 07	HADFIELD - COLOCATED MONTANA AIR QUALITY BUREAU	SUBURBAN-INDUSTRIAL QA-COLOCATED SAMPLER	EAST HELENA LEWIS & CLARK	TSP, LEAD
0860 724 F 02	DARTMAN FIELD - N OF EAST HELENA MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL SOURCE ORIENTED	EAST HELENA LEWIS & CLARK	TSP, LEAD

TABLE 16b
AQCR 142 - MONITORING SITE DESCRIPTIONS

AREA/SITE CODE	SITE NAME/ADDRESS SUPPORTING AGENCY	STATION TYPE PROJECT DESCRIPTION	CITY COUNTY	PARAMETER
1260 C24 F 03	TERRY SMITH RANCH - 5 MI E OF OVANDO MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL BACKGROUND	OVANDO POWELL	TSP, PM10

PARAMETER ABBREVIATIONS

TSP	TOTAL SUSPENDED PARTICULATES
PM10	PARTICULATE MATTER 10 (SIZE 10 MICRONS AND UNDER)
PM15	PARTICULATE MATTER 15 (SIZE 15 MICRONS AND UNDER)
DICHOT	DICHOTOMOUS SAMPLER (FINE, COARSE, AND TOTAL PARTICULATES)
CO	CARBON MONOXIDE
SO2	SULFUR DIOXIDE
WIND	WIND SPEED, WIND DIRECTION AND TEMPERATURE

TABLE 17a
AQCR 142 - TOTAL SUSPENDED PARTICULATES
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean	Geom Mean
Beaverhead/Dillon								
0420 001 F 01	Beaverhead Co. Courthouse	84	14	57	54	50	39.3	38.1
		85	56	112	97	94	48.7	44.7
		86	27	115	96	95	51.7	46.1
Deer Lodge/Anaconda								
0020 007 F 01	Lincoln School	82	58	128	125	89	40.6	24.4
		83	60	123	121	115	43.0	36.4
		84	54	210	145	132	42.4	34.7
		85	60	245	167	159	58.2	46.2
		86	30	201	181	157	64.3	52.2
0400 004 F 02	Hiway Junction	84	53	825	480	235	61.3	29.9
		85	113	151	73	72	28.3	22.7
		86	120	109	86	84	26.0	19.3
Gallatin/Bozeman								
0120 002 F 01	East Main City Building	82	52	265	180	148	67.4	56.6
		83	46	137	136	127	67.7	59.1
		84	30	198	179	174	81.1	68.8
		85	43	202	153	151	64.7	55.7
		86	56	183	183	158	72.7	64.7
0120 007 F 01	Christie Fields	85	25	62	61	50	33.2	29.6
		86	58	133	73	68	37.0	33.1

TABLE 17b
AQCR 142 - TOTAL SUSPENDED PARTICULATES
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean	Geom Mean
Jefferson/Montana City								
0760 905 F 05	Montana City School	82	18	188	182	154	86.8	73.5
		83	35	193	175	165	80.6	68.0
		84	40	349	201	196	97.9	78.4
		85	60	259	228	221	78.5	62.5
		86	59	175	165	165	67.5	58.0
Lewis and Clark/Helena								
0720 001 F 01	Cogswell Building	82	37	114	113	91	49.2	42.3
		83	55	193	165	137	48.6	41.0
		84	57	248	120	114	50.9	42.0
		85	58	273	195	189	60.5	45.8
		86	59	362	307	237	67.5	49.0
0720 013 G 05	Capital Courts	82	54	183	166	122	58.6	51.3
		83	59	232	212	178	72.8	58.6
		84	54	122	116	111	52.8	45.7
		85	60	397	213	210	67.4	50.7
		86	49	225	184	161	70.9	58.6
Lewis and Clark/East Helena								
0860 714 F 02	Firehall	83	51	142	136	131	72.1	65.5
		84	115	216	206	196	75.2	65.5
		85	115	215	207	170	67.9	59.2
		86	115	209	178	173	71.3	60.4

TABLE 17c
AQCR 142 - TOTAL SUSPENDED PARTICULATES
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean	Geom Mean
Lewis and Clark/East Helena								
0860 719 F 02	Hadfield	82	25	133	121	113	66.7	60.8
		83	67	240	232	172	74.2	65.5
		84	116	326	301	273	85.6	70.2
		85	115	273	189	173	68.6	59.4
		86	119	259	208	193	74.1	63.5
0860 719 F 07	Hadfield - Collocated	82	30	130	126	122	72.1	66.3
		83	64	239	212	192	75.6	66.7
		84	109	295	268	259	79.4	64.6
		85	115	250	182	162	66.6	58.2
		86	118	247	207	185	73.5	63.1
0860 724 F 02	Dartman Field	83	42	98	95	93	46.9	40.1
		84	59	174	114	109	50.0	40.5
		85	58	113	106	101	44.0	36.4
		86	60	145	131	128	53.1	43.8
Powell/Deer Lodge								
0380 001 F 01	Powell County Courthouse	84	19	109	87	76	48.8	42.5
		85	53	130	119	109	51.6	42.0
		86	24	119	105	79	50.0	43.9

TABLE 17d
AQCR 142 - TOTAL SUSPENDED PARTICULATES
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean	Geom Mean
Powell/Ovando								
1260 024 F 03	Terry Smith Ranch	82	56	79	79	64	20.5	14.1
		83	53	68	57	54	17.0	12.2
		84	47	231	145	97	27.8	14.8
		85	56	104	95	72	21.5	15.0
		86	59	102	72	62	23.0	17.4
Silver Bow/Butte								
0160 005 F 01	Greeley School	82	46	225	216	187	70.6	57.9
		83	56	229	224	206	64.4	50.1
		84	34	193	180	129	53.3	42.7
		85	39	314	308	257	82.9	55.0
		86	51	287	274	262	90.5	67.2

TABLE 18a
AQCR 142 - TSP - Number of Exceedances
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Federal Prim Daily 260	Federal Prim Annual G 75	Federal Sec Daily 150	Federal Sec Annual G 60	Montana Std Daily 200	Montana Std Annual A 75
Beaverhead/Dillon									
0420 001 F 01	Beaverhead Co. Courthouse	85	56	0	0	0	0	0	0
		86	27	0	0	0	0	0	0
Deer Lodge/Anaconda									
0020 007 F 01	Lincoln School	85	60	0	0	3	0	1	0
		86	30	0	0	3	0	1	0
0400 004 F 02	Hiway Junction	85	113	0	0	1	0	0	0
		86	120	0	0	0	0	0	0
Gallatin/Bozeman									
0120 002 F 01	East Main City Building	85	43	0	0	3	0	1	0
		86	56	0	0	4	1	0	0
0120 007 F 01	Christie Fields	85	25	0	0	0	0	0	0
		86	58	0	0	0	0	0	0
Jefferson/Montana City									
0760 905 F 05	Montana City School	85	60	0	0	5	1	3	1
		86	59	0	0	4	0	0	0
Lewis and Clark/Helena									
0720 001 F 01	Cogswell Building	85	58	1	0	4	0	1	0
		86	59	2	0	5	0	3	0

TABLE 18b
AQCR 142 - TSP - Number of Exceedances
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Federal Prim Daily 260	Federal Prim Annual G 75	Federal Sec Daily 150	Federal Sec Annual G 60	Montana Std Daily 200	Montana Std Annual A 75
0720 013 G 05	Capital Courts	85	60	1	0	6	0	3	0
		86	49	0	0	3	0	1	0
Lewis and Clark/East Helena									
0860 714 F 02	Firehall	85	115	0	0	5	0	2	0
		86	115	0	0	7	1	1	0
0860 719 F 02	Hadfield	85	115	1	0	5	0	1	0
		86	119	0	0	8	1	2	0
0860 724 F 02	Dartman Field	85	58	0	0	0	0	0	0
		86	60	0	0	0	0	0	0
Powell/Deer Lodge									
0380 001 F 01	Powell County Courthouse	85	53	0	0	0	0	0	0
		86	24	0	0	0	0	0	0
Powell/Ovando									
1260 024 F 03	Terry Smith Ranch	85	56	0	0	0	0	0	0
		86	59	0	0	0	0	0	0
Silver Bow/Butte									
0160 005 F 01	Greeley School	85	39	2	0	7	0	5	1
		86	51	3	0	10	0	6	1

FIGURE 7

AQCR – 142

TSP Annual Averages – Various Sites

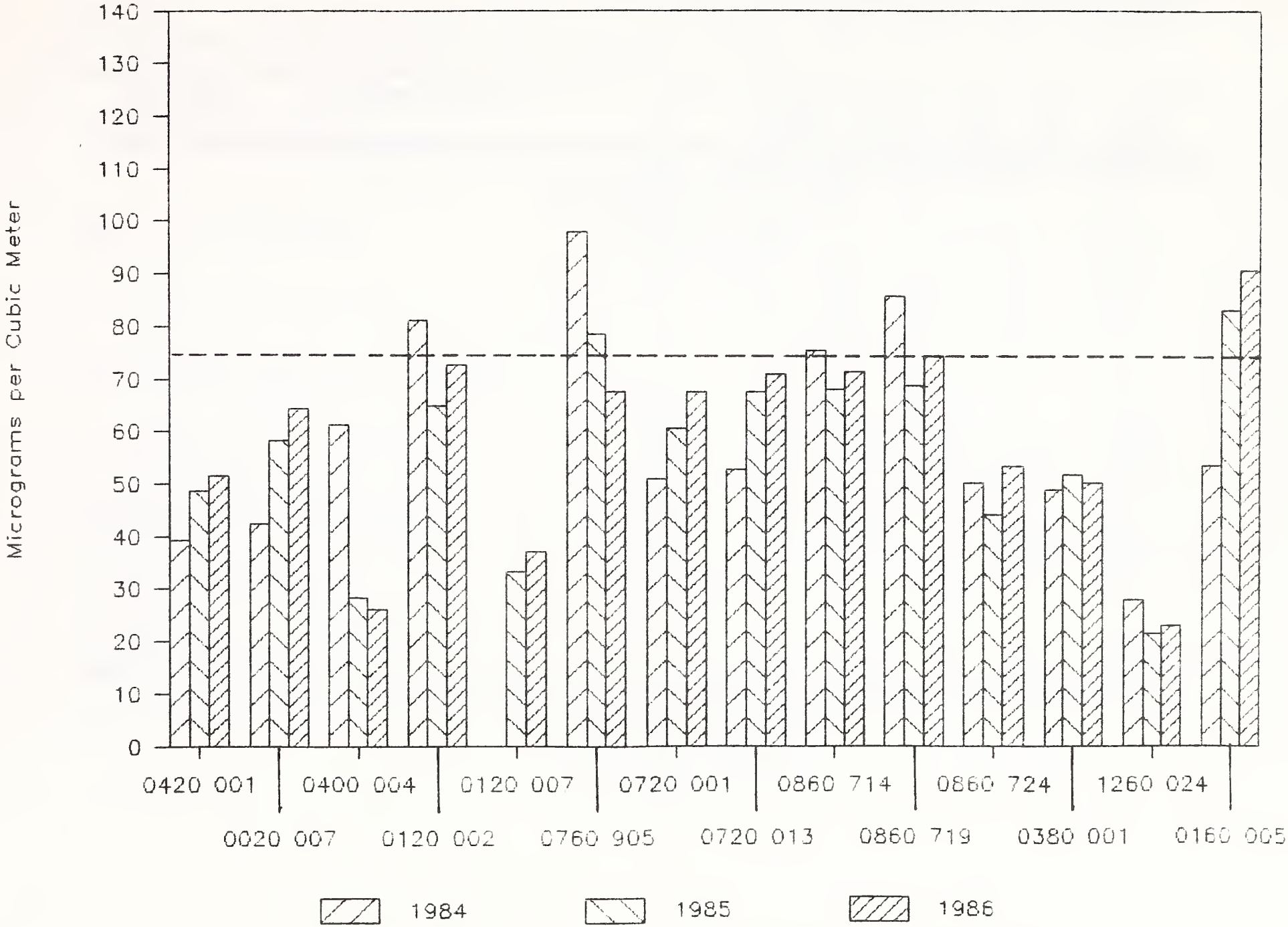


TABLE 19
AQCR 142 - ARSENIC
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Deer Lodge/Anaconda							
0020 007 F 01	Lincoln School	85	45	.232	.167	.100	.021
		86	30	.123	.049	.046	.011
0400 004 F 02	Hiway Junction	84	53	2.011	1.842	1.127	.170
		85	113	.349	.264	.259	.040
		86	120	.611	.265	.223	.033

TABLE 20
AQCR 142 - COPPER
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Lewis and Clark/East Helena							
0860 714 F 02	Firehall	83	55	32.95	23.71	23.46	6.44
		84	115	86.07	45.49	33.68	7.25
		85	115	64.52	49.08	36.65	5.88
		86	116	70.72	54.37	37.09	7.98

TABLE 21
AQCR 142 - LEAD - DAILY
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Lewis and Clark/East Helena							
0860 714 F 02	Firehall	83	55	16.75	13.13	12.73	5.04
		84	115	19.27	17.12	17.07	5.28
		85	115	17.08	12.99	12.98	3.34
		86	116	19.49	14.25	13.14	3.06
0860 719 F 02	Hadfield	82	25	7.62	6.18	4.29	2.34
		83	70	8.39	7.29	7.21	3.09
		84	116	17.73	12.88	12.79	3.48
		85	115	10.08	9.05	7.59	2.18
		86	121	11.67	11.43	9.80	2.21
0860 719 F 07	Hadfield - Collocated	82	30	7.34	6.55	5.61	2.55
		83	67	9.28	7.86	7.19	3.08
		84	109	20.43	12.58	12.03	3.23
		85	115	8.50	8.29	6.79	2.03
		86	119	11.45	11.09	10.49	2.19
0860 724 F 02	Dartman Field	83	42	9.80	7.99	7.46	2.76
		84	59	10.96	8.34	7.85	2.69
		85	58	7.14	6.74	4.46	1.51
		86	60	7.19	6.18	5.13	1.80

TABLE 22
AQCR 142 - LEAD--QUARTERLY
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Jan-Mar Num Obs	Jan-Mar Arith Mean	Apr-Jun Num Obs	Apr-Jun Arith Mean	Jul-Sep Num Obs	Jul-Sep Arith Mean	Oct-Dec Num Obs	Oct-Dec Arith Mean
Lewis & Clark/East Helena										
0860 714 F 02	Firehall	83	--	---	--	---	25	4.78	30	5.25
		84	30	5.77	27	2.74	29	5.61	29	6.82
		85	29	5.46	31	3.29	25	2.25	30	2.26
		86	27	3.17	30	1.77	31	2.34	28	5.15
0860 719 F 02	Hadfield	82	1	7.62	2	1.59	7	2.63	15	1.95
		83	15	3.27	2	3.20	24	3.00	29	3.07
		84	28	4.12	29	1.82	30	3.38	29	4.63
		85	30	3.19	29	2.16	28	1.86	28	1.41
		86	30	2.09	29	1.13	31	1.86	31	3.70
0860 719 F 07	Hadfield - Collocated	82	1	7.34	2	2.75	11	2.68	16	2.14
		83	15	3.47	2	3.36	22	2.92	28	2.98
		84	25	3.18	26	1.80	28	3.44	30	4.31
		85	29	3.05	28	2.06	27	1.68	31	1.36
		86	30	2.00	29	1.27	31	1.81	29	3.71
0860 724 F 02	Dartman Field	83	--	---	1	1.03	25	2.95	16	2.57
		84	16	3.19	15	1.26	14	3.10	14	3.23
		85	13	2.72	16	1.54	14	.61	15	1.26
		86	15	1.60	15	1.18	15	1.49	15	2.94

TABLE 23
AQCR 142 - LEAD - NUMBER OF EXCEEDANCES
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Federal Prim Cal Qtr 1.5	Montana Std 90-Day 1.5
Lewis and Clark/East Helena					
0860 714 F 02	Firehall	85	115	4	4
		86	116	4	4
0860 719 F 02	Hadfield	85	115	3	3
		86	121	3	3
0860 724 F 02	Dartman Field	85	58	2	2
		86	60	2	2

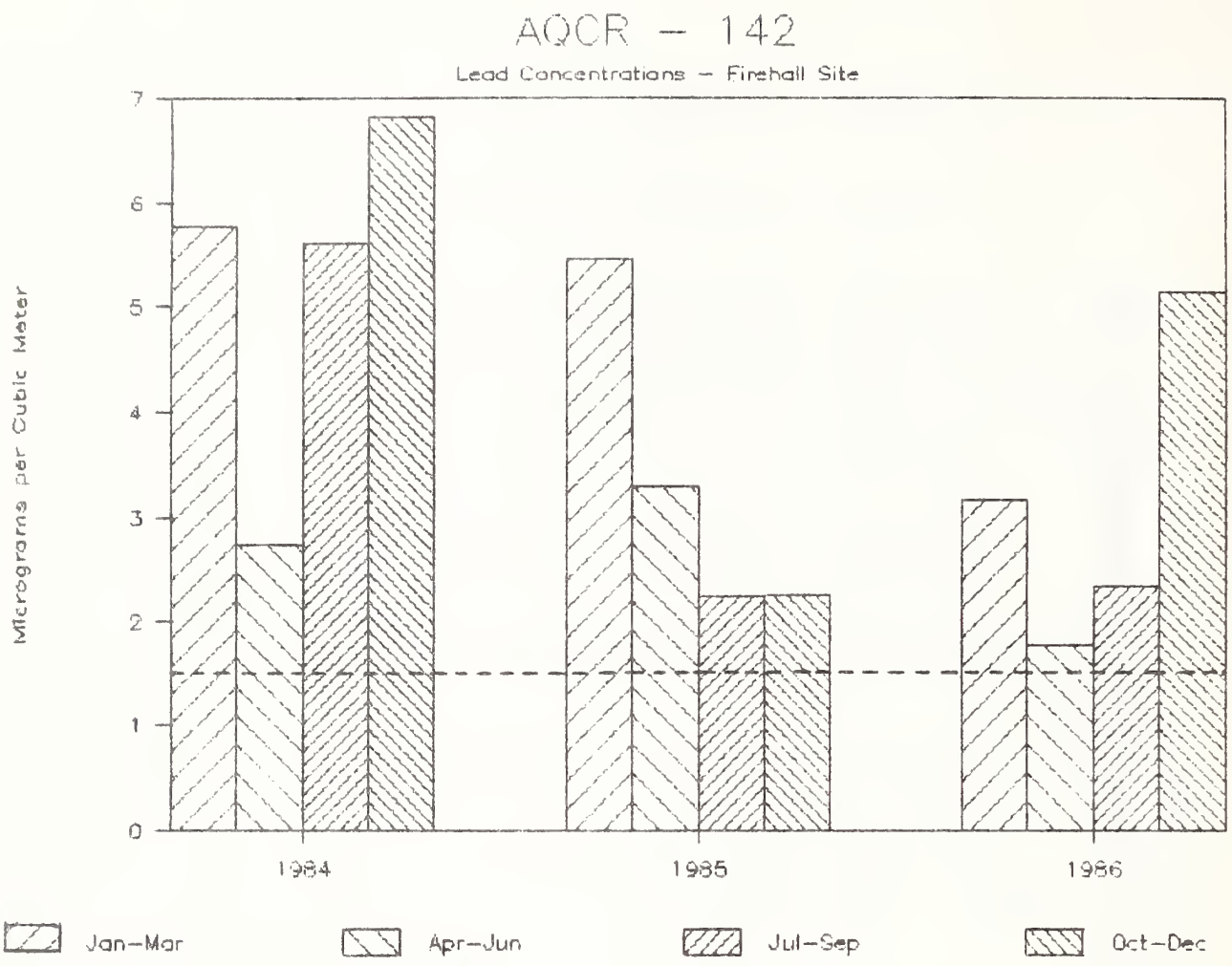

AQCR – 142
Lead Concentrations – Firehall Site
Micrograms per Cubic Meter
0
1
2
3
4
5
6
7
1984
1985
1986
Jan–Mar
Apr–Jun
Jul–Sep
Oct–Dec

FIGURE 9

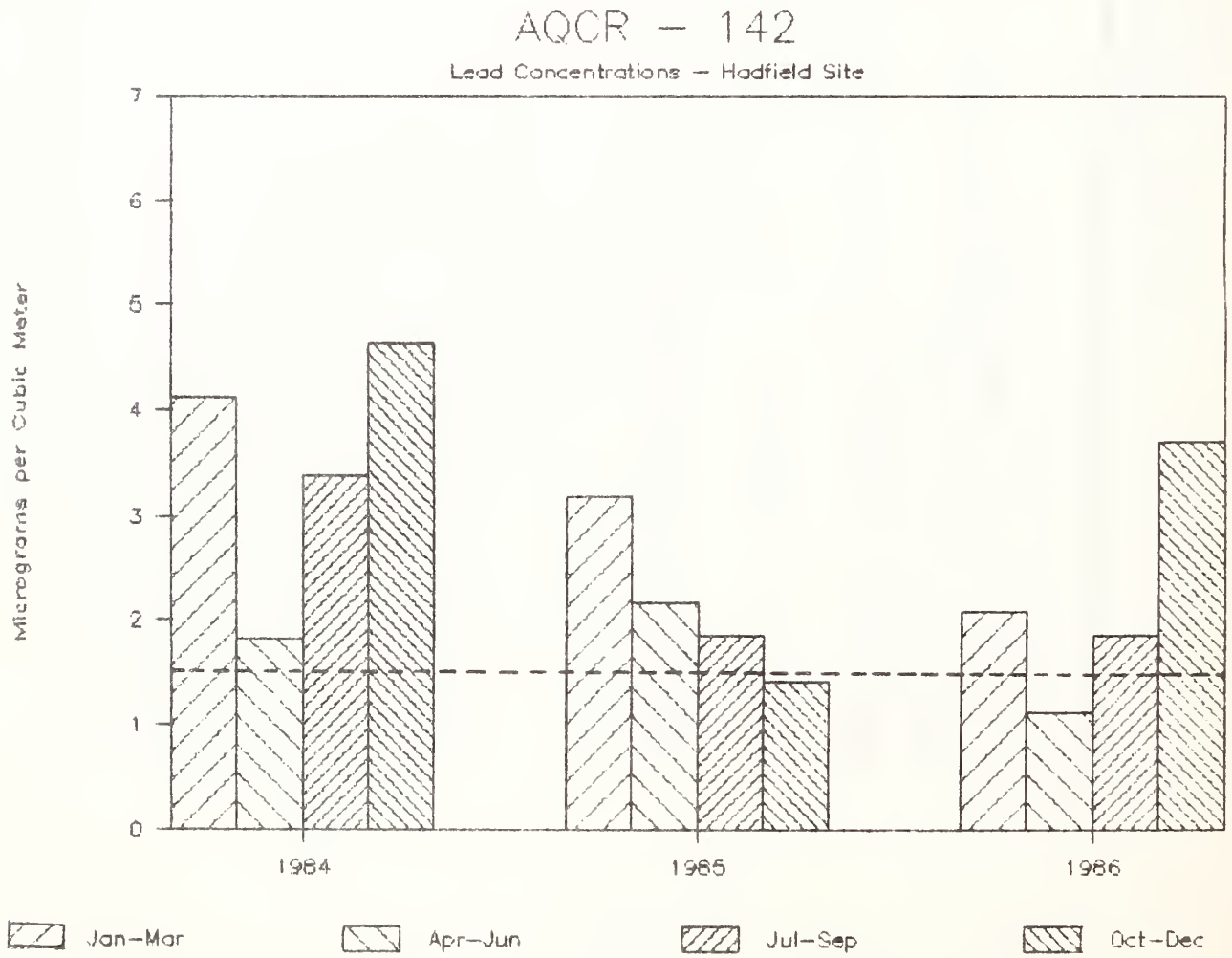

AQCR – 142
Lead Concentrations – Hadfield Site
Micrograms per Cubic Meter
0
1
2
3
4
5
6
7
1984
1985
1986
Jan–Mar
Apr–Jun
Jul–Sep
Oct–Dec

FIGURE 10

AQCR – 142

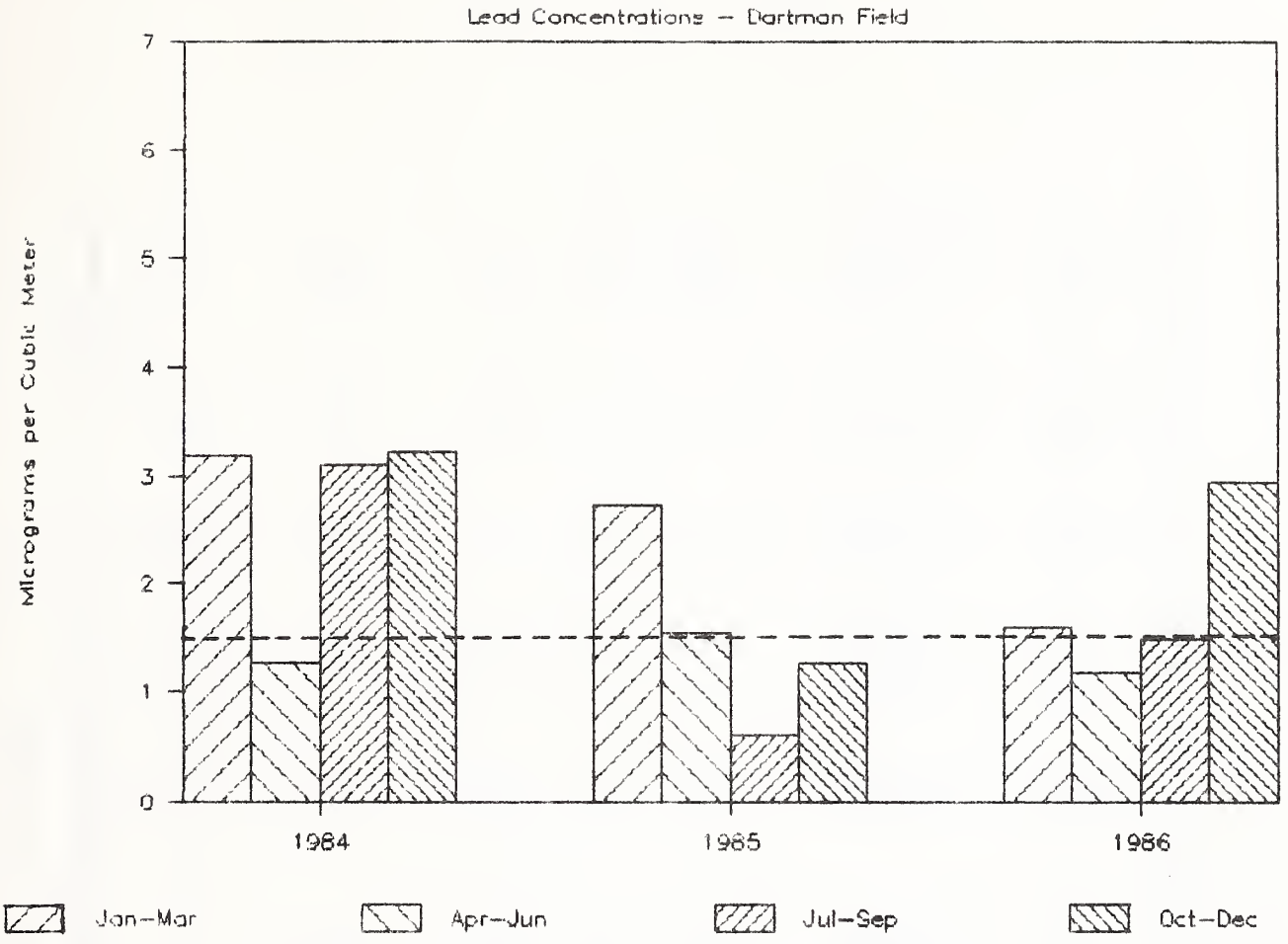


TABLE 24
AQCR 142 - ZINC
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Lewis and Clark/East Helena							
0860 714 F 02	Firehall	83	55	6.53	6.00	4.75	1.91
		84	115	16.80	12.47	10.77	3.02
		85	115	6.86	5.79	4.71	1.55
		86	116	9.99	5.62	4.61	1.41

TABLE 25
AQCR 142 - RESPIRABLE PARTICULATE (PM-10)
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Gallatin/Bozeman							
0120 002 F 01	East Main City Building	85	6	64	52	41	42.3
		86	32	88	64	64	41.6
Lewis and Clark/Helena							
0720 001 F 01	Cogswell Building	85	36	80	64	60	31.5
		86	55	140	118	105	36.5
0720 001 F 07	Cogswell Building - Coll.	85	36	83	63	61	32.8
		86	55	134	117	110	35.4
0860 009 F 01	Phillips Lane	85	31	138	65	56	34.9
		86	55	118	112	95	34.8
Powell/Ovando							
1260 024 F 03	Terry Smith Ranch	85	27	69	63	48	25.8
		86	51	76	61	50	18.4
Silver Bow/Butte							
0160 005 F 01	Greeley School	85	28	302	235	235	86.7
		86	40	213	212	211	68.1

AQCR 143

Eastern Montana

LOCATION AND PHYSICAL FEATURES

AQCR 143 makes up the eastern third of the state. Glaciated plains cover the northern half of the region (Missouri River area and north) while sedimentary plains cover the southern half. The Missouri River travels east to west in the northern half; the Yellowstone River travels in a northeast direction through the southern half. The two rivers meet just across the Montana border in North Dakota.

POPULATION

The 1986 estimated population of AQCR 143 is 100,000 or 12.2 percent of the state population. The people are scattered around the region in various small communities. The largest populated counties in the region are Richland (Sidney), Custer (Miles City) and Rosebud.

POLLUTION SOURCES

Pollution sources and types of pollutants are listed for each county in the region. A final category lists the types of sources that would be expected in all counties in the region. The sources by county are as follows:

Custer County

Grain elevator/feed processing (particulates)

Daniels County

Coal-fired power plant (actually in Saskatchewan, Canada) - (particulates, SO_2, NO_x)

Dawson County

Grain elevator/feed processing (particulates)

Phillips County

Gold mining (particulates)

Richland County

Sugar beet refinery (particulates, SO_2, NOx)

Coal-fired power plant (particulates, SO_2, NOx)

Two gas sweetening plants (SO_2)

Coal strip mine (particulates)

Oil well flares and vents (SO_2, H_2S)

Roosevelt County

Oil refinery (particulates, SO_2, NOx, CO)

Oil well flares and vents (SO_2, H_2S)

Rosebud County

Two coal strip mines (particulates)

Four coal-fired power plants (particulates, SO_2, NOx)

All Counties

Asphalt plants (particulates)

Gravel crushers (particulates)

Agricultural activities (particulates)

Wind erosion (particulates)

Automobiles (CO, NO_x, re-entrained particulates)

MONITORING SITE DESCRIPTIONS

Because of the sparse population in Eastern Montana, most of the air monitoring is limited to the Sidney area (population-oriented) and the Scobey area which is downwind from a Canadian power plant. Table 26 lists the monitoring site descriptions. This includes site codes, site name, supporting agency, station type, project description, city name and county name, and the parameters or pollutants monitored during 1986.

DATA SUMMARY

Total Suspended Particulates

TSP was monitored at two sites in this region in 1986. The maximum 24-hour observation was 256 $\mu g/m^3$ at the Sidney Downtown site. The highest annual geometric average was 56.8 $\mu g/m^3$ at the Sidney Downtown site. There was one violation of the Montana 24-hour standard of 200 $\mu g/m^3$. Table 27 summarizes the TSP data for this region and Table 28 shows the number of exceedances.

Sulfur Dioxide

Sulfur dioxide was monitored at the Marlenee Ranch beginning in September of 1986. The maximum one hour reading was .075 ppm and the

maximum three hour average was .042 ppm. Throughout the year of monitoring, there were no violations of the SO_2 standards. Table 29 summarizes the sulfur dioxide data for this region and Table 30 shows the number of exceedances.

Sulfation Rate

Sulfation rate monitoring at fifteen sites in this region was discontinued in June, 1986. The readings have remained low over the past few years. Sites in Daniels County continued to report annual averages between 0.0 and 0.03 mg SO_3/100 cm^2/day. Sites in Richland County continued a five-year downward trend. This is probably due to a decrease in oil and gas production and exploration. The high reading for Richland County was 0.06 mg SO_3/100 cm^2/day which is well below the state's 0.5 guideline for sulfation rate.

TABLE 26a

AQCR 143 - MONITORING SITE DESCRIPTIONS

AREA/SITE CODE	SITE NAME/ADDRESS SUPPORTING AGENCY	STATION TYPE PROJECT DESCRIPTION	CITY COUNTY	PARAMETER
0340 001 F 03	SCOBEY BORDER #1, US & CANADIAN BORDER MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL BACKGROUND	SCOBEY DANIELS	SULFATION RATE
0340 002 F 03	RICHARDSON, 1 MILE NORTH OF SCOBEY MONTANA AIR QUALITY BUREAU	RURAL-NEAR URBAN BACKGROUND	SCOBEY DANIELS	SULFATION RATE
0340 004 F 03	HANRAHAN RANCH, NEAR WHITETAIL MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL BACKGROUND	SCOBEY DANIELS	SULFATION RATE
0340 004 F 07	HANRAHAN RANCH, NEAR WHITETAIL MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL QA-COLOCATED SAMPLER	SCOBEY DANIELS	SULFATION RATE
0340 005 F 02	MICROWAVE TOWER MONTANA AIR QUALITY BUREAU	REMOTE SOURCE ORIENTED	SCOBEY DANIELS	SULFATION RATE
0340 006 F 02	FLAXVILLE MONTANA AIR QUALITY BUREAU	RURAL-NEAR URBAN SOURCE ORIENTED	FLAXVILLE DANIELS	SULFATION RATE
0340 007 F 02	TV TOWER HILL MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL SOURCE ORIENTED	SCOBEY DANIELS	SULFATION RATE
0340 008 F 02	SCOBEY DOWNTOWN MONTANA AIR QUALITY BUREAU	CITY CENTER-COMMERCIAL SOURCE ORIENTED	SCOBEY DANIELS	SULFATION RATE
0340 009 F 02	FOUR BUTTES MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL SOURCE ORIENTED	SCOBEY DANIELS	SULFATION RATE
0340 010 F 05	MARLENEE RANCH, NORTH OF SCOBEY MONTANA AIR QUALITY BUREAU	RURAL-INDUSTRIAL SPECIAL STUDIES	SCOBEY DANIELS	TSP, SO2, WIND
1320 010 F 01	SIDNEY DOWNTOWN - 115 2ND ST SE MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL POPULATION ORIENTED	SIDNEY RICHLAND	TSP
1320 011 F 02	#1 PETERSON-MORLOCK - 2.7 MI NW OF SIDNEY MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL SOURCE ORIENTED	SIDNEY RICHLAND	SULFATION RATE
1320 012 F 02	#2 PUBLIC WELFARE OFC - 5TH ST & 3RD AVE MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL SOURCE ORIENTED	SIDNEY RICHLAND	SULFATION RATE
1320 013 F 02	#3 SHELL OIL - 6.1 MI E JCT HWY 16 & 23 MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL SOURCE ORIENTED	SIDNEY RICHLAND	SULFATION RATE
1320 013 F 07	#3 SHELL OIL COLOCATED MONTANA AIR QUALITY BUREAU	RURAL-INDUSTRIAL QA-COLOCATED SAMPLER	SIDNEY RICHLAND	SULFATION RATE
1320 028 F 02	LUDINGTON MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL SOURCE ORIENTED	SIDNEY RICHLAND	SULFATION RATE

TABLE 26b

AQCR 143 - MONITORING SITE DESCRIPTIONS

AREA/SITE CODE	SITE NAME/ADDRESS SUPPORTING AGENCY	STATION TYPE PROJECT DESCRIPTION	CITY COUNTY	PARAMETER
1320 029 F 02	RIVER ROAD #1 MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL SOURCE ORIENTED	SIDNEY RICHLAND	SULFATION RATE
1320 030 F 02	RIVER ROAD #2 MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL SOURCE ORIENTED	SIDNEY RICHLAND	SULFATION RATE
1320 031 F 02	GOSSET RESIDENCE MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL SOURCE ORIENTED	SIDNEY RICHLAND	SULFATION RATE

PARAMETER ABBREVIATIONS

TSP	TOTAL SUSPENDED PARTICULATES
PM10	PARTICULATE MATTER 10 (SIZE 10 MICRONS AND UNDER)
PM15	PARTICULATE MATTER 15 (SIZE 15 MICRONS AND UNDER)
DICHOT	DICHOTOMOUS SAMPLER (FINE, COARSE, AND TOTAL PARTICULATES)
CO	CARBON MONOXIDE
SO2	SULFUR DIOXIDE
WIND	WIND SPEED, WIND DIRECTION AND TEMPERATURE

TABLE 27
AQCR 143 - TOTAL SUSPENDED PARTICULATES
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean	Geom Mean
Daniels/Scobey								
0340 010 F 05	Marlenee Ranch	86	15	140	45	44	28.9	18.7
Richland/Sidney								
1320 010 F 01	Sidney Downtown	83	30	116	96	92	56.1	50.8
		84	30	233	155	132	78.1	68.0
		85	50	166	138	113	57.0	50.3
		86	27	256	140	139	74.7	56.8

TABLE 28
AQCR 143 - TSP - Number of Exceedances
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Federal Prim Daily 260	Federal Prim Annual G 75	Federal Sec Daily 150	Federal Sec Annual G 60	Montana Std Daily 200	Montana Std Annual A 75
Daniels/Scobey									
0340 010 F 05	Marlenee Ranch	86	15	0	0	0	0	0	0
Richland/Sidney									
1320 010 F 01	Sidney Downtown	85	50	0	0	1	0	0	0
		86	27	0	0	1	0	1	0

TABLE 29
AQCR 143 - SULFUR DIOXIDE
Parts Per Million

Site Code	Site Name/Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	3 Hr Max	24 Hr Max	Monthly Average
0340 010 F 05	Scobey - Marlenee Ranch	86	01	---	---	---	---	---	---	---
			02	---	---	---	---	---	---	---
			03	---	---	---	---	---	---	---
			04	---	---	---	---	---	---	---
			05	---	---	---	---	---	---	---
			06	---	---	---	---	---	---	---
			07	---	---	---	---	---	---	---
			08	---	---	---	---	---	---	---
			09	451	.045	.030	.015	.024	.002	.000
			10	663	.075	.015	.015	.042	.002	.000
			11	663	.027	.023	.020	.018	.005	.000
			12	685	.035	.025	.015	.015	.004	.000
		ANNUAL		2462	.075	.045	.035	.042	.005	.000

TABLE 30
AQCR 143 - SO2 - Number of Exceedances
Parts per Million

County/City Site Code	Site Name/Location	Yr	Num Obs	Federal 24-Hr 0.14	Prim Annual 0.03	Federal Sec 3-Hr 0.50	Montana Std 1-Hr 0.50	Montana Std 24-Hr 0.10	Montana Std Annual 0.20
Daniels/Scobey									
0340 010 F 05	Marlenee Ranch	86	2462	0	0	0	0	0	0

AQCR 144

Northwestern Montana

LOCATION AND PHYSICAL FEATURES

AQCR 144 is located in the northwest corner of the state. The region is entirely west of the Continental Divide. The region contains several distinct mountain ranges separated by fairly narrow valleys. The main rivers in the region are the Clark Fork, Flathead, and Kootenai.

POPULATION

The 1986 estimated population of AQCR 144 is 212,300 or 25.9 percent of the state population. The majority of the people in this region live in Missoula County (Missoula) and Flathead County (Kalispell).

POLLUTION SOURCES

Pollution sources and types of pollutants are listed for each county in the region. A final category lists the types of sources that

would be expected in all counties in the region. The sources by county are as follows:

Flathead County

- Aluminum reduction plant (particulates, fluorides)
- Two plywood plants (particulates)
- Particleboard plant (particulates)
- Several sawmills (particulates)

Lake County

- Two sawmills (particulates)

Lincoln County

- Copper/silver mine (particulates)
- Vermiculite mining and manufacturing (particulates)
- Plywood plant (particulates)
- Sawmills (particulates)

Mineral County

- Two sawmills (particulates)

Missoula County

- Plywood plant (particulates)
- Particleboard plant (particulates)
- Several sawmills (particulates)
- Kraft pulp mill (particulates, H_2S, SO_2, NOx)

Ravalli County

- Two sawmills (particulates)

Sanders County

- Three sawmills (particulates)
- Antimony mine and mill (particulates)

All Counties

Asphalt plants (particulates)

Gravel crushers (particulates)

Automobiles (particulates, CO)

Slash and open burning (particulates, CO)

Residential wood burning (particulates, CO)

Agricultural activities (particulates)

MONITORING SITE DESCRIPTIONS

Due to the geographical and meteorological influence of this region's mountain valleys, the most intensive air monitoring was done in this AQCR. These areas tend to be affected by frequent temperature inversions during the winter and are the most resistant to control measures. Table 31 lists the monitoring site descriptions. This includes site codes, site name, supporting agency, station type, project description, city name and county name, and the parameters or pollutants monitored in 1986.

DATA SUMMARY

Total Suspended Particulates

TSP was monitored at fifteen sites in this region in 1986. Three of the sites were collocated. The maximum 24-hour observation was 572 $\mu g/m^3$ at the Lincoln County Courthouse site in Libby. The Lincoln County Courthouse site had both the highest annual geometric average of 109.0 $\mu g/m^3$ and the highest annual arithmetic average of 133.6 $\mu g/m^3$. There were five violations of the federal annual standard in Columbia

Falls, Kalispell, Libby, and Eureka. There were seven sites in violation of the Montana annual arithmetic standard in these same cities. There were nine sites in violation of the federal 24-hour standard and there were ten sites in violation of the Montana 24-hour standard.

TSP readings in western Montana are often high due to emissions from paved and unpaved roads, wood stoves, and industrial sources. Other major influences are the meteorological and physical features of the region (calm winds, inversions, and narrow valleys) which cause pollutants to be trapped and concentrations to increase. Table 32 summarizes the TSP data for this region and Table 33 shows the number of exceedances. Figure 11 shows a three-year comparison of the annual averages for most of the TSP sites in this region.

Visibility

Visibility was measured with an integrating nephelometer at one site in this region in 1986. The maximum hourly observation was 100.0 x 10^{-5} particle scattering coefficient per meter at the Libby River site. This very high reading occurred in October when a slash burn at the airport drifted directly into town. The annual average for the three months the sampler ran was 17.6 x 10^{-5} particle scattering coefficient per meter. The annual standard of 3 x 10^{-5} applies only to PSD Class I areas. This sampler was run in the fall months in conjunction with the department's smoke management program.

Montana's Smoke Management Plan is a cooperative effort of various air pollution and government agencies, the U.S. Forest Service and several industries to minimize or prevent the accumulation of smoke in

Montana when prescribed burning is necessary. Burning activities are planned and coordinated in the fall months. Weather conditions are monitored and burning restrictions are issued when smoke dispersion and atmospheric conditions are expected to exceed acceptable levels.

The smoke management group publishes an annual report each year which more fully describes the program. Appendix J also provides a brief description of this program. Table 34 summarizes the visibility data for this region.

Sulfates

Sulfates were analyzed from hi-vol filters at three sites in the Missoula area in 1986. The maximum 24-hour observation was 4.3 $\mu g/m^3$ at the Stone Container #2 site in Missoula. There is no air pollution standard for sulfates. Table 35 summarizes the sulfate data for this region.

Carbon Monoxide

Carbon monoxide was monitored at two sites in the region in 1986: Malfunction Junction and Boyd Park in Missoula. Both the maximum hourly observation of 24.5 ppm and the maximum eight hour observation of 10.0 ppm occurred at Malfunction Junction. There was one violation of the Montana one hour standard at Malfunction Juncion. Sources that contribute to CO are automotive exhaust, wood stoves, and fireplaces. Table 36 summarizes the carbon monoxide data for this region and Table 37 shows the number of exceedances.

Respirable Particulates (PM-15)

Particulate matter less than 15 microns (PM-15) was monitored at three sites in Missoula County in 1986. The maximum 24-hour observation

was 210 $\mu g/m^3$ at the Meadow Hills site. The maximum annual arithmetic mean of 67.0 $\mu g/m^3$ was measured at the Mount Jumbo School site, but only seven samples were reported at this site in 1986. There is no standard for particulate matter using this method, but it does give an indication of the respirable portion of the TSP concentrations. Table 38 summarizes the PM-15 data for this region.

Respirable Particulates (PM-10)

Particulate matter less than 10 microns (PM-10) was monitored at nine sites in this region in 1986. One of the sites was collocated. The maximum 24-hour observation was 322 $\mu g/m^3$ at the Lincoln County Courthouse site. Table 39 summarizes the PM-10 data for this region.

TABLE 31a

AQCR 144 - MONITORING SITE DESCRIPTIONS

AREA/SITE CODE	SITE NAME/ADDRESS SUPPORTING AGENCY	STATION TYPE PROJECT DESCRIPTION	CITY COUNTY	PARAMETER
0270 001 F 01	JR HIGH SCHOOL, 500 4TH AVENUE NORTH MONTANA AIR QUALITY BUREAU	SUBURBAN-RESIDENTIAL POPULATION ORIENTED	COLUMBIA FALLS FLATHEAD	TSP, PM10
0270 005 F 01	ANDERS RESIDENCE, 726 FIRST STREET MONTANA AIR QUALITY BUREAU	CITY CENTER-RESIDENTIAL POPULATION ORIENTED	COLUMBIA FALLS FLATHEAD	TSP
0270 006 F 05	981 2ND STREET (LABERE) MONTANA AIR QUALITY BUREAU	SUBURBAN-RESIDENTIAL SPECIAL STUDIES	COLUMBIA FALLS FLATHEAD	DUSTFALL, COMBUSTIBLE DUSTFALL
0900 015 F 01	UNIVERSAL ATHLETIC - 226 MAIN STREET MONTANA AIR QUALITY BUREAU	SUBURBAN-COMMERCIAL POPULATION ORIENTED	KALISPELL FLATHEAD	TSP, PM10
0900 018 F 05	PETERSON SCHOOL, 3RD ST WEST & MERIDIAN MONTANA AIR QUALITY BUREAU	CITY CENTER-RESIDENTIAL SPECIAL STUDIES	KALISPELL FLATHEAD	TSP, NICHOT
0900 012 F 01	LINCOLN CO COURTHOUSE, 418 MINERAL AVE MONTANA AIR QUALITY BUREAU	CITY CENTER-COMMERCIAL POPULATION ORIENTED	LIBBY LINCOLN	TSP, PM10
0900 012 F 07	LINCOLN CO COURTHOUSE - COLOCATED MONTANA AIR QUALITY BUREAU	CITY CENTER-COMMERCIAL QA-COLOCATED SAMPLER	LIBBY LINCOLN	TSP, PM10
0900 013 F 05	RIVER SITE - N OF LIBBY MONTANA AIR QUALITY BUREAU	RURAL-NEAR URBAN SPECIAL STUDIES	LIBBY LINCOLN	BETA LIGHT SCATTER
0900 017 F 05	HORELICK RESIDENCE, 707 MICHIGAN AVENUE MONTANA AIR QUALITY BUREAU	CITY CENTER-INDUSTRIAL SPECIAL STUDIES	LIBBY LINCOLN	DUSTFALL, COMBUSTIBLE DUSTFALL
0940 005 F 01	LINCOLN ELECTRIC CO-OP - S OF HIWAY 93 MONTANA AIR QUALITY BUREAU	RURAL-COMMERCIAL POPULATION ORIENTED	EUREKA LINCOLN	TSP
1060 001 F 05	COX RESIDENCE MONTANA AIR QUALITY BUREAU	RURAL-INDUSTRIAL SPECIAL STUDIES	ST. REGIS MINERAL	DUSTFALL, COMBUSTIBLE DUSTFALL
1080 005 G 02	MALFUNCTION JCT, SOUTH, BROOKS, RUSSELL MISSOULA CITY/COUNTY HEALTH DEPARTMENT	CITY CENTER-COMMERCIAL SOURCE ORIENTED	MISSOULA MISSOULA	CO, WIND
1100 015 G 02	STONE CONTAINER #1-RAILROAD BLUFF MISSOULA CITY-COUNTY HEALTH DEPARTMENT	RURAL-INDUSTRIAL SOURCE ORIENTED	MISSOULA MISSOULA	TSP, SULFATES
1100 015 G 07	STONE CONTAINER #1-RAILROAD BLUFF-COLLOC MISSOULA CITY-COUNTY HEALTH DEPARTMENT	RURAL-INDUSTRIAL QA-COLOCATED SAMPLER	MISSOULA MISSOULA	TSP
1100 016 G 02	STONE CONTAINER #2-WELL FIELD MISSOULA CITY-COUNTY HEALTH DEPARTMENT	RURAL-INDUSTRIAL SOURCE ORIENTED	MISSOULA MISSOULA	TSP, SULFATES
1100 020 G 01	ROSE PARK - 1/2 BLOCK FROM HIWAY 93 S MISSOULA CITY-COUNTY HEALTH DEPARTMENT	CITY CENTER-RESIDENTIAL POPULATION ORIENTED	MISSOULA MISSOULA	TSP, SULFATES, PM10

TABLE 31b
AQCR 144 - MONITORING SITE DESCRIPTIONS

AREA/SITE CODE	SITE NAME/ADDRESS SUPPORTING AGENCY	STATION TYPE PROJECT DESCRIPTION	CITY COUNTY	PARAMETER
1100 024 G 01	BOYD PARK, WASHBURN & ERNEST MISSOULA CITY-COUNTY HEALTH DEPARTMENT	SUBURBAN-RESIDENTIAL POPULATION ORIENTED	MISSOULA MISSOULA	TSP, CO, PM10
1100 029 G 01	MEADOW HILLS - BRIGGS & RESERVE MISSOULA CITY-COUNTY HEALTH DEPARTMENT	SUBURBAN-INDUSTRIAL POPULATION ORIENTED	MISSOULA MISSOULA	PM15
1100 030 G 01	SPURGIN & TOWER - SPURGIN RD & TOWER ST MISSOULA CITY-COUNTY HEALTH DEPARTMENT	SUBURBAN-INDUSTRIAL POPULATION ORIENTED	MISSOULA MISSOULA	TSP
1100 031 G 01	HEALTH DEPARTMENT, 301 WEST ALDER MISSOULA COUNTY HEALTH DEPARTMENT	CITY CENTER-COMMERCIAL POPULATION ORIENTED	MISSOULA MISSOULA	TSP, PM10
1100 031 G 07	HEALTH DEPARTMENT ROOF, 301 W ALDER MISSOULA COUNTY HEALTH DEPARTMENT	CITY CENTER-COMMERCIAL QA-COLOCATED SAMPLER	MISSOULA MISSOULA	TSP
1100 032 G 01	RATTLESNAKE GRADE SCHOOL, 120 PINEVIEW MISSOULA CITY/COUNTY HEALTH DEPARTMENT	SUBURBAN-RESIDENTIAL POPULATION ORIENTED	MISSOULA MISSOULA	TSP
1100 033 G 01	MOUNT JUMBO GRADE SCHOOL MISSOULA CITY COUNTY HEALTH DEPARTMENT	SUBURBAN-RESIDENTIAL POPULATION ORIENTED	EAST MISSOULA MISSOULA	PM10, PM15
1300 001 F 01	RAVALLI COUNTY COURTHOUSE - 205 BEDFORD MONTANA AIR QUALITY BUREAU	CITY CENTER-COMMERCIAL POPULATION ORIENTED	HAMILTON RAVALLI	TSP, PM10
1400 003 F 01	SANDERS COUNTY COURTHOUSE MONTANA AIR QUALITY BUREAU	CITY CENTER-COMMERCIAL POPULATION ORIENTED	THOMPSON FALLS SANDERS	TSP, PM10

PARAMETER ABBREVIATIONS

TSP	TOTAL SUSPENDED PARTICULATES
PM10	PARTICULATE MATTER 10 (SIZE 10 MICRONS AND UNDER)
PM15	PARTICULATE MATTER 15 (SIZE 15 MICRONS AND UNDER)
DICHOT	DICHOTOMOUS SAMPLER (FINE, COARSE, AND TOTAL PARTICULATES)
CO	CARBON MONOXIDE
SO2	SULFUR DIOXIDE
WIND	WIND SPEED, WIND DIRECTION AND TEMPERATURE

TABLE 32a
AQCR 144 - TOTAL SUSPENDED PARTICULATES
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean	Geom Mean
Flathead/Columbia Falls								
0270 003 F 01	Columbia Falls Jr. High	85	13	151	121	100	56.6	43.4
		86	49	326	256	167	93.1	79.3
0270 005 F 01	Anders Residence	82	60	241	225	186	85.4	67.0
		83	58	274	199	178	81.6	70.1
		84	60	437	407	302	115.1	90.6
		85	60	355	260	240	86.7	66.5
		86	59	519	416	297	101.4	81.8
Flathead/Kalispell								
0800 015 F 01	Universal Athletics	82	59	234	232	201	85.0	73.6
		83	48	370	210	186	84.9	72.4
		84	39	209	196	152	80.7	73.3
		85	51	441	432	263	101.9	79.1
		86	56	509	371	335	105.6	86.3
0800 018 F 05	Peterson School	86	22	101	82	80	52.6	49.5
Lincoln/Libby								
0900 012 F 01	Lincoln County Courthouse	83	50	278	207	207	106.1	90.4
		84	54	463	364	354	121.7	102.5
		85	56	642	438	392	122.2	99.6
		86	57	572	488	347	133.6	109.0
0900 012 F 07	Lincoln County Courthouse - Collocated	84	16	281	194	142	114.6	103.1
		85	53	638	471	407	132.7	107.2
		86	57	554	466	339	132.1	107.9

TABLE 32b
AQCR 144 - TOTAL SUSPENDED PARTICULATES
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean	Geom Mean
Lincoln/Eureka								
0940 005 F 01	Lincoln Electric Co-op	84	33	349	276	149	86.1	64.2
		85	43	190	159	155	69.1	58.5
		86	49	387	349	331	109.2	80.3
Missoula/Missoula								
1100 015 G 02	Stone Container #1	82	113	101	86	70	31.9	26.3
		83	104	80	69	68	29.5	25.8
		84	114	94	92	85	26.7	21.7
		85	100	111	91	87	33.6	28.3
		86	83	88	81	64	28.8	23.2
1100 015 G 07	Stone Container #1 - Collocated	82	45	65	64	63	32.0	27.5
		83	58	78	67	65	29.0	25.2
		84	60	54	52	49	25.0	21.5
		85	45	76	70	63	33.3	29.6
		86	51	80	64	61	31.1	25.9
1100 016 G 02	Stone Container #2	82	118	109	105	83	33.1	26.7
		83	102	143	101	70	20.7	24.1
		84	119	102	99	89	26.8	20.3
		85	90	105	87	87	34.2	27.6
		86	90	109	107	70	29.7	22.3
1100 020 G 01	Rose Park	82	351	381	312	221	64.6	55.2
		83	347	422	346	280	67.7	55.9
		84	346	294	264	257	64.5	53.6
		85	338	340	261	243	63.9	53.1
		86	341	373	351	342	66.5	52.4

TABLE 32c
AQCR 144 - TOTAL SUSPENDED PARTICULATES
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean	Geom Mean
Missoula/Missoula								
1100 024 G 01	Boyd Park	82	116	319	309	298	89.2	72.9
		83	139	366	336	321	88.3	72.7
		84	341	440	408	343	70.7	56.5
		85	315	309	301	289	76.5	62.5
		86	299	411	385	289	74.5	58.8
1100 030 G 01	Spurgin and Tower	83	29	125	112	98	51.7	45.8
		84	113	147	127	114	40.4	32.5
		85	113	122	110	104	45.2	37.8
		86	18	173	157	120	61.0	46.2
1100 031 G 01	Health Department	85	331	305	275	268	73.4	61.7
		86	329	363	351	324	77.7	63.5
1100 031 G 07	Health Department - Collocated	85	100	227	204	188	67.9	57.8
		86	108	377	335	274	79.9	64.5
1100 032 G 01	Rattlesnake School	86	44	101	98	97	35.7	27.9
Ravalli/Hamilton								
1300 001 F 01	Ravalli County Courthouse	83	43	181	164	126	66.6	58.6
		84	51	267	185	149	60.2	49.4
		85	53	133	130	127	52.0	45.0
		86	58	229	158	126	55.2	45.5

TABLE 32d
AQCR 144 - TOTAL SUSPENDED PARTICULATES
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean	Geom Mean
Sanders/Thompson Falls								
1400 003 F 01	Sanders County Courthouse	83	45	358	260	257	89.8	72.3
		84	47	388	370	360	106.7	81.0
		85	48	604	362	362	108.3	81.0
		86	48	273	233	172	84.2	71.1

TABLE 33a
AQCR 144 - TSP - Number of Exceedances
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Federal Prim Daily 260	Federal Prim Annual G 75	Federal Sec Daily 150	Federal Sec Annual G 60	Montana Std Daily 200	Montana Std Annual A 75
Flathead/Columbia Falls									
0270 003 F 01	Columbia Falls Jr. High	85	13	0	0	1	0	0	0
		86	49	1	1	5	1	2	1
0270 005 F 01	Anders Residence	85	60	2	0	7	1	4	1
		86	59	3	1	8	1	3	1
Flathead/Kalispell									
0800 015 F 01	Universal Athletics	85	51	3	1	8	1	7	1
		86	56	3	1	9	1	6	1
0800 018 F 05	Peterson School	86	22	0	0	0	0	0	0
Lincoln/Libby									
0900 012 F 01	Lincoln County Courthouse	85	56	3	1	12	1	4	1
		86	57	5	1	14	1	8	1
Lincoln/Eureka									
0940 005 F 01	Lincoln Electric Co-op	85	43	0	0	3	0	0	0
		86	49	3	1	11	1	6	1
Missoula/Missoula									
1100 015 G 02	Stone Container #1	85	100	0	0	0	0	0	0
		86	83	0	0	0	0	0	0

TABLE 33b
AQCR 144 - TSP - Number of Exceedances
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Federal Prim Daily 260	Federal Prim Annual G 75	Federal Sec Daily 150	Federal Sec Annual G 60	Montana Std Daily 200	Montana Std Annual A 75
Missoula/Missoula									
1100 016 G 02	Stone Container #2	85	90	0	0	0	0	0	0
		86	90	0	0	0	0	0	0
1100 020 G 01	Rose Park	85	338	2	0	15	0	4	0
		86	341	5	0	25	0	13	0
1100 024 G 01	Boyd Park	85	315	4	0	27	1	6	1
		86	299	5	0	29	0	12	0
1100 030 G 01	Spurgin and Tower	85	113	0	0	0	0	0	0
		86	18	0	0	2	0	0	0
1100 031 G 01	Health Department	85	331	3	0	22	1	6	0
		86	329	6	0	29	1	14	1
1100 032 G 01	Rattlesnake School	86	44	0	0	0	0	0	0
Ravalli/Hamilton									
1300 001 F 01	Ravalli County Courthouse	85	53	0	0	0	0	0	0
		86	58	0	0	2	0	1	0
Sanders/Thompson Falls									
1400 003 F 01	Sanders County Courthouse	85	48	3	1	6	1	4	1
		86	48	1	0	7	1	2	1

FIGURE 11

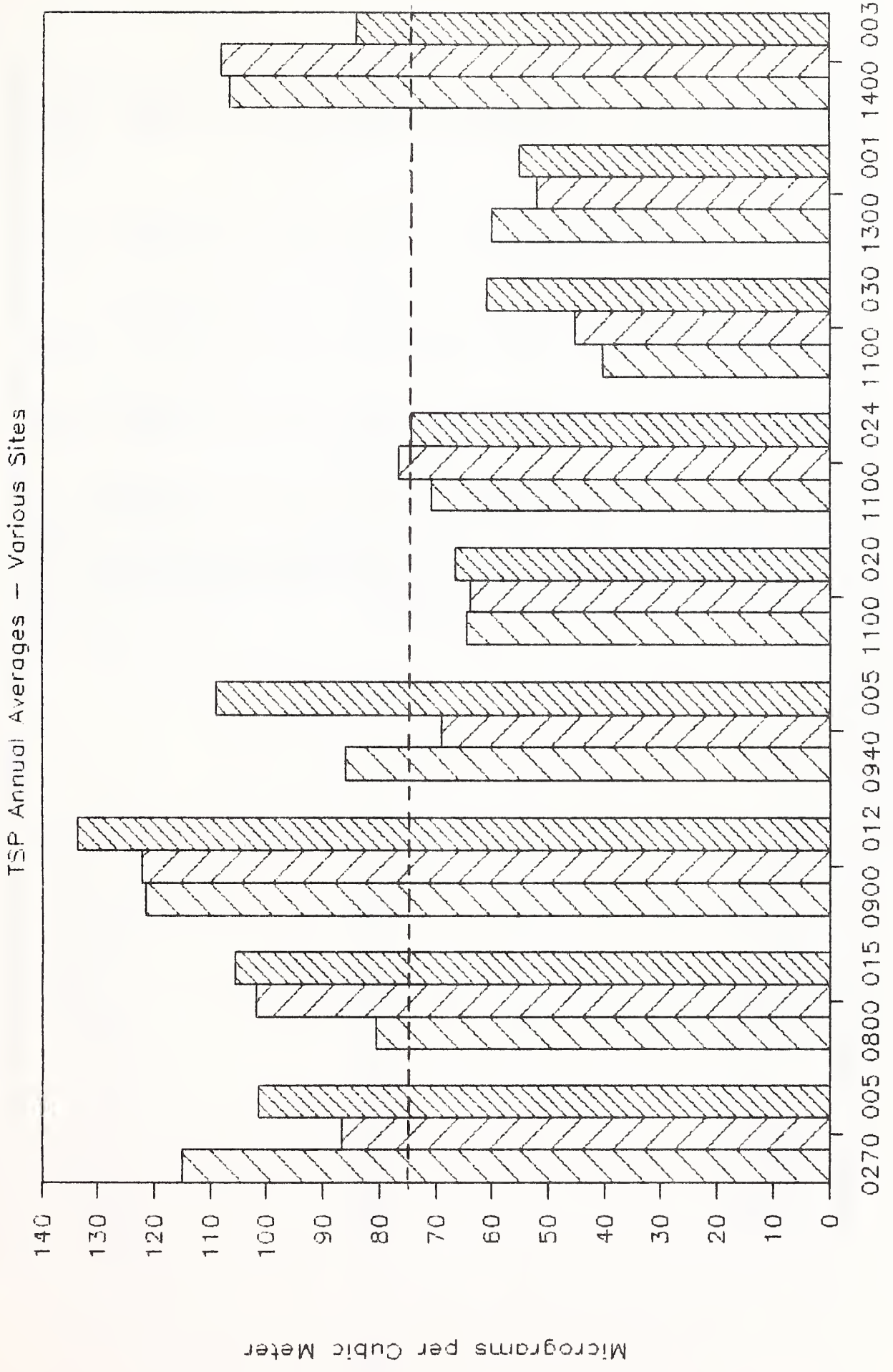

AQCR — 144
TSP Annual Averages — Various Sites
Micrograms per Cubic Meter
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0270 005 0800 015 0900 012 0940 005 1100 020 1100 024 1100 030 1300 001 1400 003
1984
1985
1986

TABLE 34a
AQCR 144 - BETA (LIGHT) SCATTER
Scattering Coefficient (X 10**5)

Site Code	Site Name/Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	Monthly Average
0900 013 F 05	Libby - River	83	01	---	---	---	---	---
			02	---	---	---	---	---
			03	---	---	---	---	---
			04	---	---	---	---	---
			05	---	---	---	---	---
			06	---	---	---	---	---
			07	---	---	---	---	---
			08	---	---	---	---	---
			09	414	36.6	34.5	33.2	8.8
			10	375	92.8	78.7	69.0	17.7
			11	599	61.7	59.5	58.2	18.4
			12	735	84.8	81.8	79.8	27.2
		ANNUAL		2123	92.8	84.8	81.8	19.4
0900 013 F 05	Libby - River	84	01	410	92.8	92.8	92.8	36.6
			02	---	---	---	---	---
			03	---	---	---	---	---
			04	---	---	---	---	---
			05	---	---	---	---	---
			06	---	---	---	---	---
			07	---	---	---	---	---
			08	---	---	---	---	---
			09	578	68.5	64.5	58.5	11.8
			10	717	80.5	77.5	72.5	16.3
			11	698	81.5	77.5	74.5	24.9
			12	---	---	---	---	---
		ANNUAL		2403	92.8	92.8	92.8	21.2

TABLE 34b
AQCR 144 - BETA (LIGHT) SCATTER
Scattering Coefficient (X 10**5)

Site Code	Site Name/Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	Monthly Average
0900 013 F 05	Libby - River	85	01	---	---	---	---	---
			02	---	---	---	---	---
			03	---	---	---	---	---
			04	---	---	---	---	---
			05	---	---	---	---	---
			06	---	---	---	---	---
			07	---	---	---	---	---
			08	---	---	---	---	---
			09	463	41.7	41.7	40.8	9.3
			10	733	69.2	55.6	53.8	15.5
			11	595	48.2	47.3	41.7	11.8
			12	---	---	---	---	---
		ANNUAL		1791	69.2	55.6	53.8	12.6
		86	01	---	---	---	---	---
			02	---	---	---	---	---
			03	---	---	---	---	---
			04	---	---	---	---	---
			05	---	---	---	---	---
			06	---	---	---	---	---
			07	---	---	---	---	---
			08	---	---	---	---	---
			09	460	61.0	54.3	50.9	9.0
			10	495	100.0	100.0	100.0	23.8
			11	532	53.6	46.3	45.5	19.2
			12	---	---	---	---	---
		ANNUAL		1487	100.0	100.0	100.0	17.6

TABLE 35
AQCR 144 - SULFATES
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Missoula/Missoula							
1100 015 G 02	Stone Container #1	82	114	16.5	9.2	7.2	2.3
		83	107	6.0	5.8	5.6	3.2
		84	113	11.0	9.9	9.7	3.2
		85	98	14.5	13.5	9.9	4.1
		86	21	3.3	3.1	3.0	2.0
1100 016 G 02	Stone Container #2	82	117	8.7	7.9	7.6	1.9
		83	101	7.0	6.0	5.7	2.7
		84	119	12.2	12.1	10.5	2.8
		85	78	9.6	8.0	7.7	2.7
		86	31	4.3	4.0	2.7	0.9
1100 020 G 01	Rose Park	82	119	9.8	7.7	7.4	2.6
		83	20	7.6	6.4	5.4	3.5
		84	78	10.3	7.5	6.8	3.7
		85	107	10.7	9.1	8.3	3.1
		86	46	3.7	2.9	2.0	0.6

TABLE 36a
AQCR 144 - CARBON MONOXIDE
Parts Per Million

Site Code	Site Name/Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	8 Hr Max	Monthly Average
1080 005 G 02	Malfunction Junction	86	01	---	---	---	---	---	---
			02	284	10.9	10.4	10.3	8.7	3.1
			03	634	8.8	8.8	8.7	8.8	2.9
			04	393	6.3	6.3	5.5	4.6	1.7
			05	520	6.0	6.0	5.4	4.0	1.7
			06	522	6.5	6.0	5.6	4.4	2.0
			07	262	6.2	5.2	5.1	3.7	1.6
			08	676	7.6	6.9	6.9	4.8	1.7
			09	363	10.4	8.0	8.0	5.6	2.0
			10	582	10.8	10.2	9.8	6.4	2.2
			11	207	11.7	9.6	9.6	7.5	3.1
			12	654	24.5	17.1	12.5	10.0	3.5
		ANNUAL		5097	24.5	17.1	12.5	10.0	---

TABLE 36b
AQCR 144 - CARBON MONOXIDE
Parts Per Million

Site Code	Site Name/Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	8 Hr Max	Monthly Average
1100 024 G 01	Boyd Park	82	01	733	10.6	10.5	10.5	9.2	2.5
			02	463	13.4	11.3	10.1	8.4	2.5
			03	619	9.0	4.3	3.5	2.0	.6
			04	702	3.4	3.3	3.0	2.2	.7
			05	210	1.4	.9	.9	.7	.1
			06	---	---	---	---	---	---
			07	---	---	---	---	---	---
			08	---	---	---	---	---	---
			09	---	---	---	---	---	---
			10	105	3.8	3.6	3.1	2.0	1.1
			11	705	8.0	8.0	7.6	5.3	1.8
			12	543	9.5	8.0	7.9	6.2	1.5
		ANNUAL		4080	13.4	11.3	10.6	9.2	---
1100 024 G 01	Boyd Park	83	01	734	15.1	14.5	13.2	9.3	2.5
			02	578	8.2	8.2	7.6	6.0	1.6
			03	---	---	---	---	---	---
			04	---	---	---	---	---	---
			05	---	---	---	---	---	---
			06	---	---	---	---	---	---
			07	---	---	---	---	---	---
			08	---	---	---	---	---	---
			09	---	---	---	---	---	---
			10	---	---	---	---	---	---
			11	---	---	---	---	---	---
			12	---	---	---	---	---	---
		ANNUAL		1312	15.1	14.5	13.2	9.3	---

TABLE 36c
AQCR 144 - CARBON MONOXIDE
Parts Per Million

Site Code	Site Name/Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	8 Hr Max	Monthly Average
1100 024 G 01	Boyd Park	84	01	666	16.5	15.0	14.8	13.3	2.5
			02	692	13.0	12.5	9.5	7.1	1.3
			03	732	9.7	8.0	6.3	3.3	0.3
			04	702	2.1	1.7	1.5	1.3	0.1
			05	737	2.7	2.1	1.6	1.1	0.2
			06	712	1.0	0.9	0.7	0.4	0.2
			07	519	1.1	0.7	0.7	0.2	0.0
			08	616	3.1	2.4	2.3	1.7	0.2
			09	714	3.8	3.6	3.4	2.6	0.5
			10	740	10.4	8.2	6.8	3.7	1.3
			11	710	9.1	8.3	7.3	5.5	1.6
			12	740	10.0	8.7	8.6	6.9	2.1
		ANNUAL		8280	16.5	15.0	14.8	13.3	---
1100 024 G 01	Boyd Park	85	01	733	12.5	11.4	11.0	9.8	1.9
			02	639	11.6	10.8	8.6	7.5	1.8
			03	438	5.3	5.2	5.1	4.0	1.0
			04	443	2.3	2.1	2.0	1.6	0.5
			05	692	2.5	2.4	2.4	1.7	0.6
			06	82	0.1	0.0	0.0	0.0	0.0
			07	---	---	---	---	---	---
			08	---	---	---	---	---	---
			09	---	---	---	---	---	---
			10	---	---	---	---	---	---
			11	---	---	---	---	---	---
			12	710	14.9	12.6	12.0	11.0	2.9
		ANNUAL		3737	14.9	12.6	12.0	11.0	---

TABLE 36d
AQCR 144 - CARBON MONOXIDE
Parts Per Million

Site Code	Site Name/Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	8 Hr Max	Monthly Average
1100 024 G 01	Boyd Park	86	01	227	11.8	11.4	11.2	8.8	3.1
			02	434	7.7	7.0	6.3	4.8	1.0
			03	736	7.7	6.3	6.0	4.6	0.9
			04	417	2.8	2.5	2.2	1.6	0.8
			05	513	2.3	2.2	1.5	1.1	0.3
			06	---	---	---	---	---	---
			07	---	---	---	---	---	---
			08	---	---	---	---	---	---
			09	---	---	---	---	---	---
			10	591	9.9	9.2	8.8	9.9	1.6
			11	645	9.6	9.4	8.9	6.8	1.3
			12	731	8.8	8.6	8.5	7.3	2.3
		ANNUAL		4294	11.8	11.4	11.2	9.9	---

TABLE 37
AQCR 144 - CO - Number of Exceedances
Parts per Million

County/City Site Code	Site Name/Location	Yr	Num Obs	Federal Prim 1-Hr 35	Federal Prim 8-Hr 9	Montana Std 1-Hr 23	Montana Std 8-Hr 9
Missoula/Missoula							
1080 005 G 02	Malfunction Junction	86	5097	0	1	1	1
1100 024 G 01	Boyd Park	85	3737	0	3	0	3
		86	4294	0	0	1	0

TABLE 38
AQCR 144 - RESPIRABLE PARTICULATE (PM15)
Micrograms/Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Missoula/Missoula							
1100 029 G 01	Meadow Hills	85	110	129	129	125	46.8
		86	53	210	190	135	45.7
1100 031 G 01	Health Department	85	23	140	129	126	76.2
		86	30	143	139	114	59.2
1100 033 G 01	Mount Jumbo School	86	7	139	111	86	67.0

TABLE 39a
AQCR 144 - RESPIRABLE PARTICULATE (PM10)
Micrograms/Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Flathead/Columbia Falls							
0270 003 F 01	Columbia Falls Jr. High	85	29	77	76	70	38.5
		86	56	146	115	108	51.8
Flathead/Kalispell							
0800 015 F 01	Universal Athletics	85	20	77	68	68	47.6
		86	57	260	198	159	61.2
Lincoln/Libby							
0900 012 F 01	Lincoln Co. Courthouse	85	26	114	114	98	58.6
		86	45	171	165	158	76.2
0900 012 F 07	Lincoln Co. Crthse. - Coll.	85	31	157	112	98	58.0
		86	54	322	214	157	86.2
Missoula/Missoula							
1100 020 G 01	Rose Park	84	22	142	109	107	51.7
		85	13	257	135	134	94.0
		86	321	240	225	216	48.5
1100 024 G 01	Boyd Park	84	20	138	127	116	57.3
		85	5	90	87	76	66.2
		86	253	238	227	177	45.4
1100 031 G 01	Health Department	85	24	140	129	126	76.0
		86	30	143	139	114	59.2
1100 033 G 01	Mount Jumbo School	86	4	79	74	71	62.0

TABLE 39b
AQCR 144 - RESPIRABLE PARTICULATE (PM10)
Micrograms/Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Ravalli/Hamilton							
1300 001 F 01	Ravalli Co. Courthouse	86	33	112	96	91	42.5
Sanders/Thompson Falls							
1400 003 F 01	Sanders Co. Courthouse	85	26	89	85	84	48.5
		86	46	113	113	91	51.4

APPENDIX A

Glossary of Air Quality Terms

APPENDIX A

GLOSSARY OF AIR QUALITY TERMS

ABSORPTION
(Engineering) The process of dissolving a gas or one of a mixture of gases in a liquid.
(Bio-medical) The taking up of fluids or other substances by the skin, mucous surfaces, or absorbent vessels.

ACID MIST
A mist of fine aqueous droplets which contain dissolved acidic compounds, such as sulfuric acid.

ACOUSTIC RADAR
A sounding device used to determine the mixing height.

ADIABATIC LAPSE RATE
The change of temperature with height of a parcel of dry air if it is lifted or lowered, with no loss or gain of heat.

ADSORPTION
The adhesion in an extremely thin layer of the molecules of gases or dissolved substances, or liquids, to the surfaces of bodies with which they are in contact.

AEROSOL
Suspended particulate matter consisting of smoke, dusts, and fumes which are either solid or droplets of liquids. Aerosol particles vary in size from well below one micron to approximately 100 microns in diameter.

AMBIENT AIR
That portion of the atmosphere, external to buildings, to which the general public has access.

AMBIENT AIR QUALITY
A physical and chemical measure of the concentration of various chemicals in the ambient atmosphere. The quality is usually determined over a specific time period.

ANTHRACITE
A type of a coal, hard, with high luster, which contains little volatile matter distinguishing it from bituminous coal.

AROMATIC
In organic chemistry, designating a large class of organic compounds which contain benzene rings. The simplest aromatic compound is benzene.

ASTM

ASTM (American Society for Testing Materials) is a voluntary organization of companies and individuals, established for the purpose of setting up standard methods of testing, so that different individuals can obtain comparable test results upon the same sample. ASTM standard test methods are available for almost all types of materials, including some air pollutants. An ASTM apparatus is the specific apparatus designated by ASTM for a specific test.

ATMOSPHERIC PRESSURE (Also called barometric pressure)

The pressure exerted by the atmosphere as a consequence of gravitational attraction exerted upon the "column" of air lying directly above the point in question. As with any gas, the pressure exerted by the atmosphere is ultimately explainable in terms of bombardment by gas molecules; it is independent of the orientation of the surface on which it acts.

Atmospheric pressure is one of the basic meteorological elements. It is measured by many varieties of barometer, and is expressed in several units. The most common unit used is the millibar (one millibar equals 1000 dynes per cm^2). Unique to the science of meteorology is the use of inches (or millimeters) of mercury; that is, the height of a column of mercury that exactly balances the weight of the column of atmosphere whose base coincides with that of the mercury column. Also employed are units of weight per area and units of force per area. A standard atmosphere has been defined in terms of equivalence to each of the above unit systems, and it is used as a unit itself.

ATTAINMENT AREA

A geographic area in which the quality of the air is better than federal air pollution standards. PSD requirements apply to attainment areas.

ATOMIZING SCRUBBER

A wet collector in which use is made of a liquid medium to increase the size of aerosol particles to facilitate its removal from a gas stream. In an atomizing scrubber, water is introduced at the throat of a venturi through which gas (containing aerosol particles) is moving at high velocity. Units of this type have a high pressure drop, and are used to get high removal efficiencies for particles of relatively small diameters (e.g., below 1.5 microns).

BACT - "Best Available Control Technology"

The term best available control technology means an emission limitation based on the maximum degree of reduction of each pollutant subject to regulation under this Act emitted from or which results from any major emitting facility, which the permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility through application of production processes and available methods, systems and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of each such pollutant. [Clean Air Act, Section 169(3)].

BART - "Best Available Retrofit Technology"

An emission limitation based on the degree of reduction achievable through the application of the best system of continuous emission reduction for each pollutant which is emitted by an existing stationary facility. The emission limitation must be established, on a case-by-case basis, taking into consideration the technology available, the costs of compliance, the energy and nonair quality environmental impacts of compliance, any pollution control equipment in use or in existence at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology.

BAGHOUSE

An enclosure containing many cloth bag filters. Dust laden air entering at the top or bottom of a bag is discharged through the cloth directly to the atmosphere while the solid particles are deposited inside the bag.

BITUMINOUS

A type of coal, soft, which yields considerable volatile matter when heated. Burning this type of coal in open fireplaces or household stoves has caused serious air pollution problems (London, formerly in Pittsburgh and Saint Louis) because of the lack of sufficient temperature above the firebed to burn the volatilized gases and tars (i.e., both gaseous and particulate emissions).

BRONCHITIS

Inflammation of the bronchial tubes (wind pipe), which includes the bronchi (s. bronchus) and the choncia (s. bronchium) and through which air passes to the lungs.

BULK DENSITY

The quotient of the total mass of a mixture (usually liquid plus solid or gas plus solid) divided by the total volume.

CARBON DIOXIDE (CO_2)

A colorless, odorless, incombustible gas, used to make carbonated beverages, dry ice, etc. It is a product of respiration, combustion, fermentation, decomposition and other natural processes, and is always present in the atmosphere.

CASCADE IMPACTOR

A device for separating dust particles from a moving air stream. In principle a dust particle collides or impacts on a solid surface and thus is collected while the air stream moves around the solid surface. An assembly of a series of such surfaces is called a cascade impactor.

CHROMATOGRAPHY

A technique used by chemists to cause the separation of small amounts of chemical compounds in order to determine their identity and quantity.

CIRCULATION PATTERN
The general geometric configuration of atmospheric circulation at a given time and region.

CLASS I AREA
Any area which is designated for the most stringent degree of protection from future degradation of air quality. The Clean Air Act designates as mandatory Class I areas each national park over 6,000 acres and each national wilderness area over 5,000 acres.

CLASS II AREA
Any area cleaner than federal air quality standards which is designated for a moderate degree of protection from future air quality degradation. Moderate increases in new pollution may be permitted in a Class II area.

CLASS III AREA
Any area cleaner than federal air quality standards which is designated for a lesser degree of protection from future air quality degradation. Significant increases in new pollution may be permitted in a Class III area.

CLEAN AIR ACT
A law enacted by Congress to protect and enhance the quality of the nation's air resources so as to promote the public health and welfare and the productive capacity of its population.

CRITERIA POLLUTANT
A pollutant for which EPA has established a national ambient air quality standard under Section 109 of the Clean Air Act. Present criteria pollutants are: carbon monoxide, hydrocarbons, lead, nitrogen dioxide, ozone, sulfur dioxide and total suspended particulate.

CLOTH FILTER
A cloth bag filter; see BAGHOUSE

COLLECTION EFFICIENCY
The ratio of the weight fraction of aerosol which is retained in the collector to that which entered the collector. Collection efficiency could be specified in terms of particle numbers or other physical characteristics for special cases.

COMBUSTION
The rapid reaction of carbon containing substances (or other oxygen demanding materials) with oxygen producing a rapid temperature increase and a flame.

COMBUSTION CHAMBER
That part of a furnace or incinerator in which burning takes place.

CONING
A name which describes the approximate shape of a smoke plume in a neutral atmosphere (see FANNING).

CONVECTION
(In meteorology) a mechanical process thermally produced involving the upward and downward transfer of a limited portion of the atmosphere.

CYCLONE COLLECTOR
A device for separating solid particles from gases or liquids. The carrier gas or liquid is made to move in a rapid spiralling motion (cyclonic) throwing the solids by centrifugal force to the walls of the collector.

DEPOSITION VELOCITY
The minimum velocity of a small particle suspended in a moving air stream that will give the particle sufficient momentum to carry it into a target (deposit the particle on a collecting surface). At lower velocities the particle will remain in the air stream and go around the target.

DEW POINT (or dew point temperature)
The temperature to which a given parcel of air must be cooled at constant pressure and constant water vapor content in order for saturation to occur.

DISPERSION
The action of mixing air containing a high concentration of pollutants arising from a pollutant source with the ambient air thereby reducing the ambient pollutant concentration.

DUST COLLECTORS
Any device used to remove particulate matter from exhaust streams.

DUSTFALL
The amount of large particulate matter deposited per unit time per unit area of surface.

ELECTROLYTIC BATH
A container of liquid or molten materials through which an electric current is passed to cause chemical decomposition.

ELECTROSTATIC PRECIPITATOR
A device for collecting dispersed particles. Particle laden air is passed between two surfaces carrying a high electric potential and under the force of the electric field the particles are driven to a collecting electrode and precipitated.

EMPHYSEMA
The presence of air in the alveolar tissue of the lungs due to rupture of the alveoli. Progressive development of this condition leads to enlargement of the lungs and the chest cavity simultaneously with reduced capacity for breathing and efficiency of breathing.

FANNING
The characteristic appearance of a smoke plume emitted under extreme inversion conditions, where little vertical mixing of smoke in the atmosphere takes place (see CONING).

FLUE GASES
All the gases discharged from any stationary combustion process.

FLUE GAS DESULFURIZATION
One of several processes by which sulfur dioxide is removed from the flue gas as a disposal solid, elemental sulfur or sulfuric acid.

FLUORIDE
The generic name of all simple chemical compounds containing fluorine, as sodium fluoride.

FLUORINE
A nonmetallic chemical element, a pale yellow, highly corrosive and toxic gas.

FLUOROSIS
Chronic poisoning by fluorides.

FLY ASH
The non-combustible particles contained in flue gas.

FOSSIL FUELS
Oil, coal or natural gas.

FREE LIFT
The actual lifting force of an inflated balloon, usually expressed in grams. The free lift plus the weight of the balloon and attached equipment is the total lift.

FUME
A fume is formed by sublimation of solid particles from the gaseous state. The term is frequently used to describe suspensions of very small (submicron) particles.

GASIFICATION
The process of converting solid or liquid fossil fuels to gaeous fuel, usually with the elimination of sulfur.

GRAVITY SETTLING
The application of gravitational force to cause solid particles to drop out of the air. Practically it is useful for removing only particles larger than 50 microns in size.

HALOGEN
Any of the five very active, nonmetallic chemical elements: fluorine, chlorine, bromine, iodine, and astatine.

HYDROCARBON

Any of the class of compounds consisting solely of hydrogen and carbon.

1. Paraffins whose molecules contain the maximum possible of hydrogen.
2. Aromatics, whose molecules contain benzene rings.
3. Naphthenes, whose molecules are ring shaped.
4. Olefins, whose molecules contain double bonds.

HYDROFLUORIC ACID

A water solution of hydrogen fluoride. In the gaseous state, hydrogen fluoride is colorless, corrosive, and poisonous.

HYDROGEN

The most simple chemical element and the lightest of all gases. It is found chiefly combined with oxygen to form water; also found in acids, bases, hydrocarbons, etc.

INCINERATORS

Any device to burn solid and combustible liquid residues or wastes in order to reduce their bulk. The ash residue may be used for landfill or dumped at sea. Flue fed incinerators are those where the garbage or refuse is supplied to the combustion chamber through the same flue used for discharge of the products of combustion. A power generating or combination incinerator is one in which the heat from refuse combustion is used to generate steam. Primary air is usually supplied with the material being burned. Secondary air is usually supplied to complete combustion of incompletely burned gaseous fractions over the fuel bed. Tertiary air may be supplied to further improve combustion in a secondary chamber.

INCREMENTS

The amount of additional pollution, beyond already existing background levels, which may be allowed in a particular PSD area. The size of allowable increment varies with whether the area is Class I, Class II or Class III.

INVERSION

A meteorological condition in which the temperature of the atmosphere rises with increased elevation instead of falling; a negative temperature lapse rate.

INVERSION LAYER

A layer in the atmosphere through which the temperature remains constant or increases with altitude.

ICAP - Inductive Coupled Argon Plasma

Measurement of emission spectra which is excited by radiofrequency in a plasma. The emissions from analytes will produce signals on a photomultiplier tube.

INTEGRAL VISTA

A view perceived from within the mandatory Class I Federal area of a specific landmark or panorama located outside the boundary of the mandatory Class I federal area.

ISOKINETIC

Having the same speed and direction. When sampling gas streams for certain purposes it is important that the gas flow into the sampler be of the same speed and direction as the main gas stream. This is called isokinetic sampling.

LAER - Lowest Achievable Emission Rate

A requirement applying to proposed new or modified major stationary sources in nonattainment areas. LAER means the rate of emissions which reflects:

a. The most stringent emission limitation which is contained in the (SIP) of any state for such class or category of source.... or
b. the most stringent emission limitation which is achieved in practice..., whichever is more stringent.

LAPSE RATE

The change in an atmospheric variable, usually temperature, with height.

LIGNITE

A naturally occurring coal-like material often having a distinct woody texture.

MACROMETEOROLOGY

Large-scale weather events as opposed to local micrometeorological events.

MERCAPTAN

One of a class of sulfur-containing organic chemical compounds (R-SH), which have an extremely offensive odor.

METEOROLOGY

The science dealing with the atmosphere and its phenomena, particularly relating to weather.

METHANE

The first of the series of hydrocarbons (CH). It is a colorless, odorless, flammable gas and is the chief constituent of natural gas.

MICROMETEOROLOGY

The science of small-scale weather events.

MICRON (MU)

A metric unit of measure of length equal to one millionth of a meter and to one thousandth of a millimeter. This unit is often used for describing sizes of airborne particles and is commonly designated by the Greek letter μ (mu).

MIXING HEIGHT (or mixing depth)
The thickness of the atmospheric layer, measured from the surface upward, through which pollutants are presumed to mix by virtue of convection caused by daytime heating at the surface. The designation of mixing height implies the existence of an inversion, in which case the mixing height is also the height of the inversion base.

NECROSIS
Gradual decay in trees or plants.

NESHAPS - National Emission Standards for Hazardous Pollutants
EPA has adopted emission standards for sources of asbestos, beryllium, vinyl chloride, and mercury.

NITROGEN OXIDES
Compounds of nitrogen including N_2O, NO, NO_2, NO_3, N_2O_3, N_2O_4, N_2O_5. Those most commonly encountered in the atmosphere are nitrous oxide (N_2O), a normal constituent of the air, and nitric oxide (NO) and nitrogen dioxide (NO_2) which are classified as pollutants.

NONATTAINMENT AREA
A geographic area in which the quality of the air is worse than federal air pollution standards. PSD requirements do not apply in nonattainment areas.

NSPS - New Source Performance Standards
EPA emission standards for certain categories of new or modifed air pollutant sources.

OPACITY
A measurement of visible emissions defined as the degree, expressed in percent, to which emissions reduce the transmission of light and obscure the view of an object in the background.

OXIDANT
Any chemical element or compound which will cause any other element to increase in positive valence in a chemical reaction. Less precisely, any chemical element or compound, e.g. NO_2, including oxygen, which has the same effect as oxygen in a chemical reaction. In photochemical smog, the sum of all compounds detected by reaction with reducing agent, e.g., potassium iodide solution.

OZONE
A form of oxygen, O_3, having three atoms of oxygen to the molecule. It is found in the atmosphere in minute quantities and is a powerful oxidizing agent. It is a toxic constituent of photochemical smog.

PARAFFINS
A class of saturated hydrocarbons characterized by their chain-like molecular structure. See HYDROCARBON.

PARTICLES

Any solid matter emitted by a pollutant source. It is composed of settleable matter (which will settle as dust within a reasonable period of time) and suspended matter (which remains suspended in the atmosphere until washed out by precipitation, deposited by impaction, or some other process).

PARTICULATE MATTER

Finely divided solids or liquids. See AEROSOL.

PHOTOCHEMICAL SMOG

Air pollution resulting from light-induced reaction between certain organic materials and nitrogen dioxide.

PILOT BALLOON

A small balloon whose ascent is followed by a theodolite in order to obtain data for the computation of the speed and direction of winds in the upper air.

PILOT-BALLOON OBSERVATION (Commonly pibal)

An observation method for winds aloft; that is, the determination of wind speeds and directions in the atmosphere above a station. This is done by reading the elevation and azimuth angles of a theodolite while visually tracking a pilot balloon.

The ascension rate of the balloon is approximately determined by careful inflation to a given total lift. After release from the ground, periodic readings (usually at one-minute intervals) of elevation and azimuth angles of the balloon are recorded. These data are transferred to a winds-aloft plotting board, and the wind speed and direction at selected levels are calculated by trigonometric methods.

PREVAILING WIND DIRECTION (or prevailing wind)

The wind direction most frequently observed during a given period. The periods most frequently used are the observational day, month, season and year.

PSD - Prevention of Significant Deterioration

A planning and management process under Sections 160 through 169 of the CAA for allocation and use of air resources.

RADIATION INVERSION

A type of atmospheric inversion occurring usually at night when the earth's surface loses heat by radiation, thus cooling the layer of air next to the ground. See INVERSION.

RESIDUAL FUEL OIL

The remainder after the more valuable petroleum gas, gasoline, lubricants, paraffin waxes and asphalt are removed from petroleum. This heavy oil is used as fuel and is graded number 4, 5, or 6, with the heavier grades bearing higher numbers. These grades are also

cheaper and usually contain more sulfur. The amount of sulfur in the "RESID" depends on the feed stock (source of the crude oil) and the use of dehydrosulfurization processes.

RINGLEMANN CHART
A chart showing four numbered shades of gray as well as pure white and all black, used by visual comparison for estimating the density of smoke as it emerges from a stack. The matched comparison with the chart is referred to as a Ringlemann number.

SCATTERING COEFFICIENT
Amount of back scatter of light due to suspended particulate matter in the air and relates the measurement to visibility and the level of particulates.

SCRUBBER
Any device in which an aerosol is removed from a gas stream by a liquid droplet.

SETTLING CHAMBER
A simple particulate control device which consists of a large expansion in a flue or duct which results in a reduced pollutant velocity and subsequent particulate settling. The settled particulate is then mechanically removed from the chamber.

SETTLING VELOCITY
The speed at which an object will move through its surroundings under the force of gravity.

SIP - State Implementation Plan
A state developed, federally approved plan for implementing and enforcing requirements of the CAA.

SMOG
A combination of smoke and fog, usually generated as a result of atmospheric contamination. London (England) type smog arises as a result of the combined presence of sulfur oxides and particulates in a humid environment. Los Angeles smog or photochemical smog occurs when sunlight generated reactions involving hydrocarbon, ozone and nitrogen oxide take place. The smog is most visible when high concentrations of water vapor occur in the atmosphere simultaneously but may appear as a bluish haze in a dry atmosphere.

SOLAR RADIATION
The total electromagnetic radiation emitted by the sun.

SOOT
Aggregated particles of unburned carbon produced by incomplete combustion. The soot may contain sufficient amounts of sulfur oxides or compounds to damage paint or enamel finishes.

SPRAY CHAMBER
The simplest type of gas scrubber. Gas is passed countercurrent to falling drops of liquid (usually water) from a bank of spray nozzles. A typical appliction is the removal of fly ash and cinders from flue gases.

STABLE
Pertaining to the atmosphere or an atmospheric layer in the condition of static stability, that is, an atmosphere whose temperature lapse rate and moisture distribution is such as to suppress vertical exchange of air.

STAGNATION
With respect to air pollution, the persistence of a given volume of stable air over a region, permitting an abnormal buildup of pollutants from sources within the region.

STATIC STABILITY (Also called hydrostatic stability, vertical stability, convective or convectional stability)
The state of the atmosphere when it is stable relative to vertical displacements. Such an atmosphere tends to remain stratified, in that any air that is displaced vertically is subjected to a buoyant force that tends to restore it to its original level.

Static stability is determined primarily by the temperature lapse rate; an inversion layer is an extreme example of a statically stable layer.

STOICHIOMETRIC
In the exact combining proportions of materials involved in a specific chemical reaction.

SUBSIDENCE INVERSION
An atmospheric inversion due to the downward motion or air, about a stationary high-pressure area with concomitant adiabatic temperature rise. Such an inversion is common to Southern California in the warm months of the year. See INVERSION.

SURFACE INVERSION (or ground inversion)
A temperature inversion based at the earth's surface; that is, an increase of temperature with height beginning at the ground level.

This condition is due primarily to greater loss of heat due to radiation at and near the surface than at levels above. Thus, surface inversions are common over land prior to sunrise and in winter over high-latitude continental interiors.

SYNERGISM
Cooperative action of discrete pollutants such that the total effect is greater than the sum of the two effects taken independently.

TEMPERATURE INVERSION

A layer in which temperature increases with altitude. The principal characteristic of an inversion layer is its marked static stability, so that very little turbulent exchange can occur within it. Strong wind shears often occur across inversion layers, and abrupt changes in concentrations of atmospheric particulates and atmospheric water vapor may be encountered on ascending through the inversion.

When, in meteorological literature and discussion an "inversion" is mentioned, a temperature inversion is usually meant.

THEODOLITE

An optical instrument which consists of a sighting telescope mounted so that it is free to rotate around horizontal and vertical axis and graduated scales so that the angles or rotation may be measured. The telescope is usually fitted with a right-angle prism so that the observer continues to look horizontally into the eyepiece, whatever the variation of the elevation angle. In meteorology, the theodolite is used principally to observe the motion of a pilot balloon.

TOTAL LIFT

The upward force produced by the gas in a balloon. It is equal to the sum of the free lift, the weight of the balloon, and the weight of auxiliary equipment carried by the balloon.

WET COLLECTORS

Dust collectors which operate by contacting the dust with a liquid (usually water). The class includes spray chambers and atomizing scrubbers.

WIND

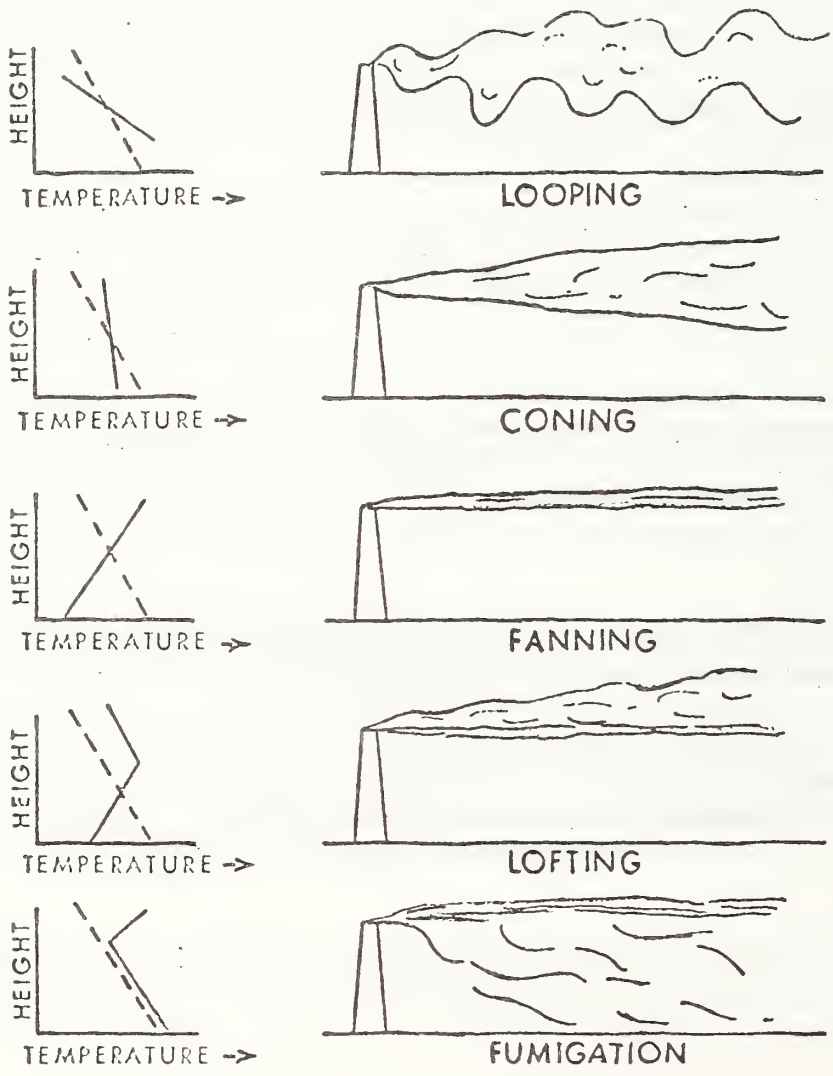
Air in motion relative to the surface of the earth. Since vertical components of atmospheric motion are relatively small, especially near the surface of the earth, meteorologists use the term to denote almost exclusively the horizontal component. Vertical winds are always identified as such.

WIND ROSE

A diagram showing the wind direction and speed and their variations for a day, a month, or any other specified period of time, for a specific location and altitude.

WIND VANE

An instrument used to indicate wind direction.


HEIGHT
TEMPERATURE
LOOPING
HEIGHT
TEMPERATURE
CONING
HEIGHT
TEMPERATURE
FANNING
HEIGHT
TEMPERATURE
LOFTING
HEIGHT
TEMPERATURE
FUMIGATION

APPENDIX B

Ambient Air Quality Standards

APPENDIX B

AMBIENT AIR QUALITY STANDARDS

In December, 1977, the Montana Board of Health and Environmental Sciences directed the Air Quality Bureau to propose an administrative rule containing new enforceable ambient air quality standards.

A set of standards had been on the books for ten years; however, they were considered as goals or guidelines rather than enforceable standards.

It was decided that before new standards were adopted there should be a thorough review to determine whether the old standards were still appropriate or whether scientific research completed since their adoption indicated different standards were necessary.

Subsequently, $147,000 was provided to hire a staff and consultants. This study was called the Montana Ambient Air Quality Standards Study (MAAQS).

As a result of this work a draft environmental impact statement was published in January, 1979; a final statement in February, 1980.

After several public hearings and testimony from numerous "experts", the Board of Health and Environmental Sciences adopted a set of "enforceable" standards in August, 1980. Table AP-B-I lists the Montana and national ambient air quality standards. Additional information about the standards is provided on the following page.

Table AP-B-I

MONTANA AND NATIONAL AIR QUALITY STANDARDS

POLLUTANT	MONTANA STANDARD	FEDERAL PRIMARY STANDARD	FEDERAL SECONDARY STANDARD
Total Suspended Particulates	75 µg/m³ annual average 200 µg/m³ 24-hr average*	75 µg/m³ annual geo. mean 260 µg/m³ 24-hr average*	60 µg/m³ annual geo. mean 150 µg/m³ 24-hr average*
Sulfur Dioxide	0.02 ppm annual average 0.10 ppm 24-hr average* 0.50 ppm 1-hr average**	0.03 ppm annual average 0.14 ppm 24-hr average*	0.5 ppm 3-24 average*
Carbon Monoxide	9 ppm 8-hr average* 23 ppm hourly average*	9 ppm 8-hr average* 35 ppm 1-hr average*	9 ppm 8-hr average*
Nitrogen Dioxide	0.05 ppm annual average 0.30 ppm hourly average*	0.05 ppm annual average	0.05 ppm annual average
Photochemical Oxidants (ozone)	0.10 hourly average*	0.12 ppm 1-hour average*	0.12 ppm 1-hr average*
Lead	1.5 µg/m³ 90-day average	1.5 µg/m³ calendar qtr. avg.	None
Foliar Fluoride	35 µg/g grazing season avg. 50 µg/g monthly average	None	None
Hydrogen Sulfide	0.05 ppm hourly average*	None	None
Settled Particulate (Dustfall)	10 gm/m² 30-day average	None	None
Visibility	Particle scattering coefficient of 3×10^{-5} per meter annual average***	None	None

µg/m³ = micrograms pollutant per cubic meter of sampled air.
ppm = parts pollutant per million parts of sampled air.
*Not to be exceeded more than once per year.
**Not to be exceeded more than 18 times per year.
***Applies to PSD mandatory Class I areas.

Air quality standards have been developed at the national level for six classes of air pollutants and at the state level for nine pollutants plus visibility. Below is a synopsis of each of the pollutants.

Sulfur Dioxide - Sulfur dioxide originates from the burning of fossil fuels such as coal or oil and the smelting of metals ores. The pollutant is known for causing significant loss in crop yield, rusting metals, reducing visibility, and causing irritation of eyes, nose, throat, and lungs.

Particulate Matter - Particulate matter may originate from natural sources such as forest fires and erosion, or result from automobiles, industrial processes, unpaved roads, agriculture, construction, and other human activities. These tiny particles can damage paint, reduce visibility, and carry poisonous chemicals into the lungs causing cellular damage.

Carbon Monoxide - Carbon monoxide is a by-product of the incomplete combustion of organic fuels. The most notorious source is the automobile. This odorless gas can, in small amounts, cause headaches, dizziness, fatigue, and slow reactions. It can be especially dangerous for people with heart disease. In larger amounts it can cause death.

Photochemical Oxidants (Ozone) - Photochemical oxidants are produced in the atmosphere when hydrocarbons and nitrogen oxides, combustion wastes from gasoline and other fuels, are exposed to sunlight. Oxidants irritate the eyes, nose, and throat, make breathing difficult, reduce visibility, and damage vegetation.

Hydrocarbons - Hydrocarbons are the unburned chemicals from the combustion or evaporation of organic compounds. Automobile exhaust and uncontained storage of petroleum products are common sources of hydrocarbons. They have been known to cause vegetative damage and contribute to photochemical oxidants.

Nitrogen Oxides - Nitrogen oxides usually originate in high-temperature combustion processes including diesel engines. It is not only a component of photochemical oxidants, but causes an unpleasant smelling brown haze, and is irritating to the nose and throat.

Fluoride - Sources of fluorides include the aluminum, glass, brick, fertilizer and, to a small degree, the oil industries. In excessive amounts, fluorides can cause bone deformities and damage vegetation.

Lead - Lead in the air is generally the result of automobiles and ore smelters. Physical problems of high lead content include gastrointestinal cramps, central nervous system effects, kidney disease, and anemia.

Hydrogen Sulfide - Sources of hydrogen sulfide, the "rotten egg" pollutant include sewage treatment, kraft pulp, and oil industries. The pollutant can damage paint, tarnish copper, injure vegetation, produce a loss of the sense of smell, cause severe respiratory tract irritation, and in large doses, cause death.

Visibility - Visibility reductions are due to the amounts of TSP, aerosols, and gases present in the atmosphere.

APPENDIX C

Attainment Nonattainment Designations

APPENDIX C

ATTAINMENT-NONATTAINMENT DESIGNATIONS

INTRODUCTION

The 1977 Clean Air Act Amendments, enacted by Congress August 7, 1977, contained many new and expanded requirements regarding the control of air pollution. One of the most significant requirements was to classify areas of the state according to whether they met the National Ambient Air Quality Standards (NAAQS). The department classified each area of the state into one of three categories: attainment - meeting the standards, nonattainment - exceeding the standards, or unclassified - insufficient information to determine the status. The areas which were designated nonattainment were required to develop revised State Implementation Plans to control emissions and bring the areas into compliance.

Classification Requirements

Five classifications were possible - three for particulate matter (PM) and sulfur dioxide (SO_2) and two for pollutants other than particulate matter or sulfur dioxide. The five classifications are summarized below.

A) Do not meet a national primary ambient air quality standard for oxidants, carbon monoxide (CO) or nitrogen dioxide (NO_2).

B) Do not meet, or in the judgment of the State will not attain or maintain in the time required by the applicable SIP, any national primary ambient air quality standard for sulfur dioxide or particulate matter.

C) Do not meet a national secondary ambient air quality standard.

D) Cannot be classified as B or C, on the basis of available information, for PM or SO_2.

E) Have ambient air quality levels better than any national primary or secondary ambient air quality standard for oxidants, CO or NO_2, or for which there is insufficient data to be classified A or C.

Areas designated as A, B or C were referred to as nonattainment areas, and areas designated as D or E were referred to as attainment (or unclassified) areas.

Air Quality Data

The department used, whenever possible, the last four consecutive quarters of air quality data to propose the designations. Data was available from two ozone sites, two nitrogen oxides sites, three carbon monoxide sites, eleven sulfur dioxide sites, and fifty total suspended particulate sites.

Designation Proposal

On January 6, 1978, the department submitted to EPA a proposed attainment/nonattainment designation document. The table which follows is a summary of that document. It should be noted that rural areas (less than 50,000 pop.) with high total suspended particualte concentrations were not designated nonattainment if the primary cause of the violations was uncontaminated (non-industrial) fugitive dust.

TABLE AP-C-I

ATTAINMENT STATUS

1. Oxidants

The department proposed that the entire state be unclassified for oxidants.

2. Nitrogen Oxides

	Designation		
Designated Area	107(d)(1)(A) Nonattainment	107(d)(1)(E) Unclassified	107(d)(1)(E) Attainment
Billings, MT area			*
Colstrip, MT			*
Butte, MT		*	
Rest of State		*	

3. Carbon Monoxide

	Designation		
Designated Area	107(d)(1)(A) Nonattainment	107(d)(1)(E) Unclassified	107(d)(1)(E) Attainment
Billings Downtown Area	*		
Butte Area		*	
Colstrip Area		*	
Great Falls		*	
Missoula Area	*		

TABLE AP-C-I (Continued)

ATTAINMENT STATUS

4. Sulfur Dioxide

Designated Area	Designation: Nonattainment 107(d)(1)(B) Primary	107(d)(1)(C) Secondary	107(d)(1)(D) Not B or C
Laurel Area	*		
East Helena Area	*		
Billings			*
Colstrip Area			*
Rest of State			*

5. Total Suspended Particulate

Designated Area	Designation: Nonattainment 107(d)(1)(B) Primary	107(d)(1)(C) Secondary	107(d)(1)(D) Not B or C
Decker			*
Hardin			*
Billings Downtown		*	
Billings Area			*(1)
Great Falls CBD		*	
Great Falls Area			*(2)
Butte Area		*	
Philipsburg			*(1)
East Helena		*	
Three Forks			*(1)(2)
Miles City			*

TABLE AP-C-I (Continued)

ATTAINMENT STATUS

Designated Area	Designation: Nonattainment 107(d)(1)(B) Primary	107(d)(1)(C) Secondary	107(d)(1)(D) Not B or C
Ekalaka			*(2)
Fort Peck			*
Lame Deer			*
Scobey			*
Glendive			*
Colstrip		*	
Broadus			*(1)
Lindsay			*(1)
Poplar			*
Columbia Falls	*		
Kalispell			*(1)
Libby			*
Troy			*
Missoula Area	*	*	

(1) Violation of standard due to fugitive dust from non-industrial sources - unpaved roads, etc.
(2) Insufficient data from which to classify the area.

Revisions/Considerations of the Original Designation Proposal

Soon after the department submitted its original proposal in 1978, new data indicated other areas were violating standards. In the years that followed, plans and considerations to the original proposal have developed. The following discusses some of the revisions and considerations of the original designation proposal.

Statewide - TSP/PM10

On July 31, 1987, the Environmental Protection Agency (EPA) promulgated new ambient air quality standards for particulate matter. The new standards changed the focus from larger particles (total suspended particulates - TSP) to smaller inhalable particles known as PM10 (particles with an aerodynamic diameter less than 10 microns).

As a result of the new standards, parts of Montana which were nonattainment for TSP are now predicted to be in attainment with the new PM10 standards. On the other hand, some areas will remain nonattainment and a few areas which were attainment for TSP will now be nonattainment for PM10 standards.

After reviewing existing TSP and PM10 data, the state and EPA have assigned various parts of Montana to one of three categories. Seven communities were identified as Group I areas (likely to violate the standards), six as Group II areas (may violate the standards) and the rest of the state was considered in attainment. Table AP-C-II below identifies the grouping and the corresponding SIP requirements.

TABLE AP-C-II

PM10 GROUPINGS AND SIP REQUIREMENTS

Grouping	Communities	SIP Requirements
I	Libby, Kalispell, Polson, Ronan, Missoula, Butte and Lame Deer	1. Daily PM10 monitoring 2. Develop control plan by May 1, 1988 3. Implement control plan within 3 years after EPA approval
II	Eureka, Columbia Falls, Thompson Falls, Anaconda, Helena and Hays	1. Every other day monitoring 2. Commit to determining the compliance status of the area
III	Rest of state	

1. Billings - TSP

Billings was designated as non-attainment for total suspended particulates. The TSP plan was approved on March 4, 1980 (45 FR 14036). The secondary standard for TSP is nearing attainment as a result of extensive street sweeping and flushing programs. With the promulgation of the PM10 standards, the department and EPA predict that Billings will be in compliance with particulate standards. The department intends to request that the area be redesignated to attainment as part of our May, 1988, PM10 SIP submittal.

2. Billings - CO

Billings was also designated as nonattainment for carbon monoxide. The plan for attainment of the 8-hour CO standard predicted that a modification of the Exposition Drive-First Avenue North intersection would achieve the standards. A proposal to approve the plan appeared on July 23, 1984 (49 FR 29620). Final approval was given on January 16, 1986, (51 FR 2397).

Data collected during the two years following the modification to Exposition Drive (1985-1986) indicates compliance with the standards. Unfortunately, the amount of data collected did not meet completeness requirements and EPA requested that the monitoring site be relocated to a position nearer the road. Therefore, Yellowstone County will initiate CO monitoring during the fall of 1987 at a new EPA-approved location. If the data indicates compliance, the department will submit a request to redesignate the area to attainment in 1989.

3. Butte - TSP

Soon after the Department submitted its proposal, additional data from Butte indicated the area was violating primary standards for total suspended particulates. As a result, EPA immediately promulgated a nonattainment designation for Butte for violation of the primary standard.

The original SIP called for attaining the standard through enforcement of the airborne particulate rule. The Department of Health and Environmental Sciences and Department of Highways were to develop a set of emission factors for paved and unpaved roads and apply these factors to the appropriate streets in the Butte area. As it turned out, the development of these factors proved impossible. The department turned its attention to developing a control plan in conjunction with the Anaconda Minerals Company (ARCO) and the city of Butte.

A plan which called for a permit from ARCO and street paving and sweeping by the City of Butte was developed and approved by the Board of Health. The plan was submitted to EPA in February 1983. EPA has made several inquiries into the plan regarding attainment of the short-term standard. The state has submitted information showing that the short-term standard was never exceeded in Butte through 1984. EPA indicated that they would only designate the area attainment for the primary standard since the modeling submitted did not show attainment of the secondary standard.

No formal action has been taken in the Federal Register since the department submitted a plan and a request for attainment in 1983. In the meantime, particulate levels in Butte have increased to the point where TSP and PM10 primary standards are once again being exceeded. The department is studying the problem to determine the major emission sources and will submit a PM10 SIP revision in May, 1988.

4. Colstrip - TSP

Colstrip was designated as nonattainment for TSP in 1978. The control strategy involved a permit for the nearby coal mines. Such a permit was evaluated and issued according to the plan.

EPA proposed to approve the plan on July 5, 1983, (48 FR 30696) and then again on July 23, 1984, (49 FR 29620). The plan was finally approved on April 26, 1985, (50 FR 16475).

Montana, in cooperation with Montana Power Company, Western Energy Company, and Peabody Coal Company, prepared a redesignation request. The request was submitted to EPA and given final approval on April 26, 1985, (50 FR 16475). The change in status from nonattainment to attainment applies only to the primary standard. The area remains nonattainment for the secondary TSP standard.

With the promulgation of the PM10 standards, the department and EPA predict that Colstrip will be in compliance with particulate standards. The department intends to request that the area be redesignated to attainment as part of our May, 1988, PM10 SIP submittal.

5. Columbia Falls - TSP

Columbia Falls was designated as non-attainment for total suspended particulates based upon the Anders monitoring site. The control strategy for this area involved the rebuilding of Highway 40 and Nucleus Avenue through Columbia Falls. The paving project for Nucleus was completed in late fall, 1982. Highway 40 was finished in fall, 1984. Data to date does not exhibit a clear pattern. The readings had been dropping as a result of the SIP, but other factors may now be influencing the site.

In July, 1987, the department and EPA designated Columbia Falls as a Group II area for PM10. In September, 1987, every other day PM10 monitoring was initiated. Contingent upon the results of the monitoring, either a commitment to further monitoring or a PM10 SIP submittal will be required in May, 1988.

6. East Helena - TSP

East Helena was designated as a non-attainment area for total suspended particulates based upon the Hastie monitoring site. No special control strategy was implemented since the emission inventory demonstrated over 50% of the particulate emissions were from near-by highway construction. In addition, ASARCO agreed to reduce TSP emissions from slag piles by spraying the piles with water or other coating material. The data from Hastie for years 1981-85 indicate compliance with primary and secondary standards. The data for the Hadfield and Firehall sites, however, are slightly higher. These data indicate exceedances of the secondary standard in 1985 and 1986. With the promulgation of the PM10 standards, the department and EPA predicted that East Helena will be in compliance with particulate standards. The department intends to request that the area be redesignated to attainment as part of our May, 1988, PM10 SIP submittal.

7. East Helena - SO_2

East Helena was designated non-attainment for sulfur dioxide in 1977. The ASARCO smelter installed an acid plant with several modified stacks to reduce the sulfur dioxide emissions. Data for the past six years shows no violations of national or Montana ambient air quality standards.

The department submitted a plan designed to achieve compliance on April 24, 1979. On November 20, 1980 (45 FR 76685), EPA conditionally approved the plan contingent upon the department's demonstrating that the stack represented "good engineering practice." The department submitted the demonstration report on October 18, 1982. Although the department, on October 24, 1983, requested that the area be redesignated to attainment for sulfur dioxide and EPA proposed to approve the plan (7/5/83, 48 FR 30696), final action was not taken due to litigation concerning the federal stack height regulations. As a result of the litigation, the federal stack height rule was revised on July 5, 1985 (50 FR 27892). Montana submitted a revised stack height rule to EPA on March 28, 1986. At this time, EPA has not taken final action on the department's stack height rule or the request for redesignation.

8. East Helena - Lead

EPA promulgated ambient air quality standards for lead on October 5, 1978. The East Helena area was determined to be in violation of the lead standards based on data from the Hastie site.

The department conducted extensive studies to determine the proper source apportionment. Based upon this data, a SIP plan was developed in cooperation with ASARCO, American Chemet, the City of East Helena, and the Montana Department of Highways. The plan was approved by the Board of Health and Environmental Sciences and submitted to EPA on September 29, 1983. EPA gave final approval to the plan on July 9, 1984 (49 FR 27944). The plan required ASARCO to control several fugitive dust sources including the ore storage piles and roads in and out of the facility. ASARCO also was to install an air control system on the #1 blast furnace and enclose the top of both blast furnaces and ventilate the exhaust to the baghouse. The Montana Highway Department was required to regularly sweep Highway 12 through East Helena.

As of December 31, 1986, all the control strategies in the plan were implemented. However, ambient monitoring data for the first two quarters of 1987 indicate that lead concentrations are still over the standard. The department will be revising the control strategies over the upcoming months.

9. Great Falls - TSP

The Great Falls area was designated nonattainment of the secondary standard for total suspended particulates. The city has instituted a sweeping/flushing program to control particulate emissions. Data for 1983 indicate compliance with the secondary standard while 1982, 1984, and 1985 show exceedances of the secondary standard. With the promulgation of the

PM10 standards, the department and EPA predict that Great Falls will be in compliance with particulate standards. The department intends to request that the area be redesignated to attainment as part of our May, 1988, PM10 SIP submittal.

10. Great Falls - CO

A corridor along 10th Ave. South was designated as nonattainment for carbon monoxide in September, 1980. The Great Falls City-County Planning Agency was designated as the lead agency to develop a SIP. The plan was developed in conjuction with the Highway Department and Air Quality Bureau. The plan shows that an improvement in automobile emissions as a result of EPA-mandated emission standards and reductions at the Montana Refining Company (formerly Phillips Petroleum Company) will bring the area into compliance by the end of 1985 or 1986. In addition to the improvements in automobiles, the city has completed a number of projects such as improved traffic synchronization, widening of the Warden Street bridge, and a new mass transit system which should assure attainment.

During the review process, it was discovered that emission reductions planned at the Montana Refining Company never occurred. The department discussed this matter with Montana Refining and a compromise solution was worked out. This reduced the base year emissions from 10,000 tons/year to approximately 4,700. The revised plan was approved by the board on March 7, 1986, and subsequently submitted to EPA on March 28, 1986. EPA proposed to approve the plan on January 26, 1987 (52 FR 2732) and the state expects final approval very soon. The Cascade County Health Department will continue to perform air monitoring to determine whether the plan is successful.

11. Missoula - TSP

The city of Missoula has been designated as nonattainment for total suspended particulates. The city has incorporated a systematic program of street sweeping and flushing to show attainment by 1982. Although not actually part of the plan, Missoula has implemented several control measures directed at emissions from residential wood stoves. The plan was approved by EPA in September 23, 1980 (45 FR 62984). EPA approved a minor revision to the plan (removing two street paving projects) on January 16, 1986. Data to date indicates compliance with the annual TSP standard, but an occasional excursion of the 24-hour standard.

Ambient air quality data also indicates that Missoula exceeds the new PM10 standards. The Missoula County Health Department will be developing a new PM10 SIP over the next year.

12. Missoula - CO

Missoula was designated as nonattainment for carbon monoxide based upon a monitoring station near the intersection of Brooks, Russell, and South (Malfunction Junction). A plan was developed which called for the reconstruction of the intersection. This reconstruction was completed in late 1985. The plan was proposed for approval on July 23, 1984 (49 FR 29620) and received final approval on January 16, 1986, (51 FR 2397).

EPA's approval notes that the potential exists that areawide sources such as wood stove emissions may be contributing to the problem and this needs to be watched closely in the future.

The Missoula County Health Department will continue to monitor CO. Contingent on the results, an SIP revision or a request for redesignation will be in order.

13. Laurel/Billings - SO_2

The Laurel area was designated as nonattainment for sulfur dioxide due to readings near the Cenex refinery. Modeling calculations showed potential violations within the Billings area as well. In 1977, a stipulation was signed between the various sulfur dioxide sources and the Department of Health and Environmental Sciences to further study the matter. The stipulation also required some modifications at these sources. An ambient sampling program, as required by the stipulation, was completed in October, 1982. The results of the ambient air quality monitoring indicate compliance with the national standards except for one 3-hour episode in January, 1985. The department has investigated this matter and traced the problem to a malfunction at the Conoco refinery.

The department and the Billings area industries will be monitoring SO_2 in the Billings/Laurel area over the next year and a half. Based on the results, the department will either submit a revised SIP for Laurel or redesignate the area attainment for SO_2.

14. Anaconda - SO_2

The Anaconda area was designated nonattainment for sulfur dioxide. The area experienced frequent violations of the ambient air quality standards for sulfur dioxide as a results of the Anaconda Company (ARCO) copper smelter complex. In July, 1980, the smelter temporarily ceased operations as a results of a strike. In September of the same year, Anaconda announced it was permanently ceasing operations at the smelter. As a result of these conditions, the state requested the area be redesignated to attainment. The designation to attainment was made final on July 15, 1982 (47 FR 30762).

Impacts of Designation

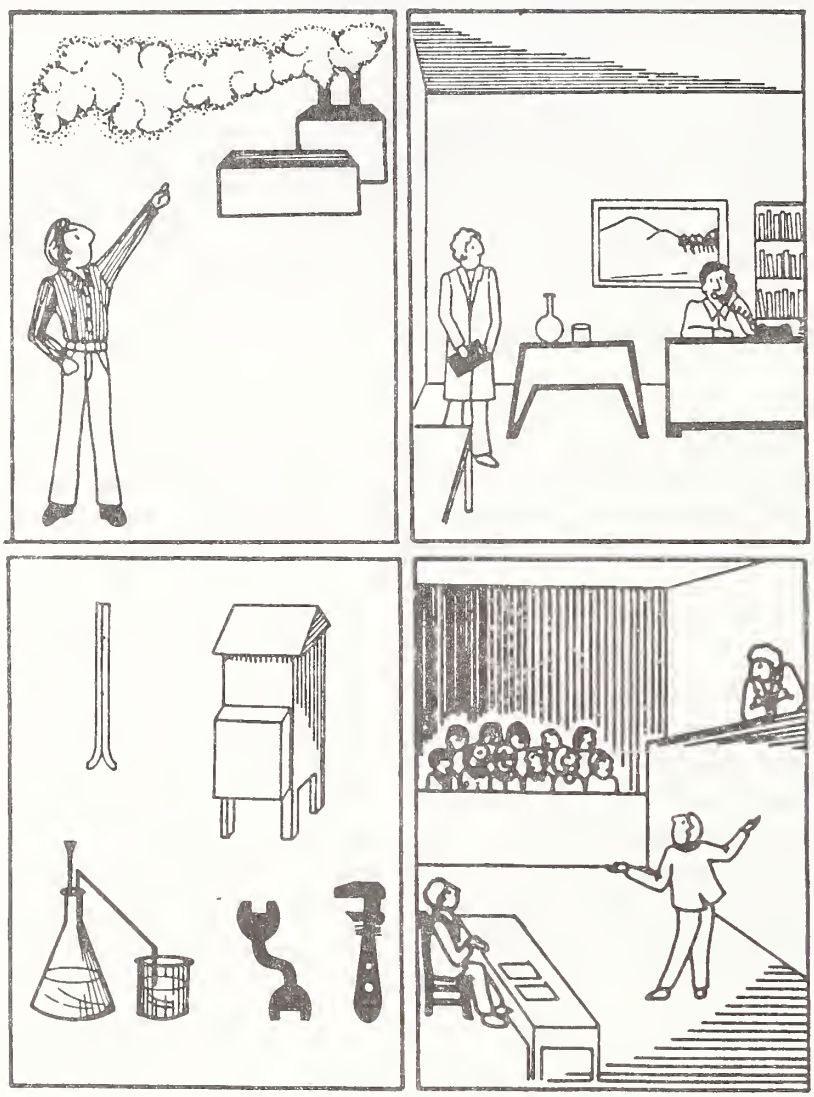
Designation of an area as nonattainment triggers the requirement to develop a control plan to bring the area into compliance. The final compliance date for primary sulfur dioxide and total suspended particulate standards was December 31, 1982. For carbon monoxide and oxidants, the act provided for extensions up to December 31, 1987.

Although Montana has areas which exceed the PM10 and lead standards, these areas are not subject to the same requirements of other nonattainment areas. These areas are required to develop control strategies but have three years from the date EPA approves the control plan to comply.

The department developed control plans for each of the nonattainment areas and they are contained in the State Implementation Plan. Many of

the plans were modified as more accurate air quality and emissions data became available. Some of the plans such as the East Helena sulfur dioxide plan were carried out with good success. Others were unnecessary due to plant shutdowns as was the case in Anaconda. The plans for carbon monoxide have been followed and are showing progress toward compliance. Although plans were developed for particulates, progress has been slow due to expensive and untried control strategies and the need for frequent plan modifications. Nevertheless it appears that compliance with the primary total suspended particulate standard has been achieved in Colstrip and Columbia Falls. In addition, the promulgation of the PM10 standards will remove the TSP nonattainment designation for secondary standards in Colstrip, Great Falls and Billings.

The department is continuing to work on the particulate problem; however, the newly promulgated PM10 standard may change the appropriate control strategies. Since the PM10 standard considers only particles less than 10 microns in diameter vs. 40 microns for total suspended particulate, control strategies will need to be directed at sources of fine particulate.



APPENDIX D

Precision & Accuracy

APPENDIX D

Precision/Accuracy

Precision applies to the repeatability of the instrument and is obtained by the use of collocated samplers (TSP) or the introduction of a known low ppm gas concentration on a weekly or oftener basis. Ninety-five percent confidence levels (probability limits) are then calculated from the average % difference and the standard deviation % difference. $PL = \bar{X} \pm 1.96\ SD/\sqrt{2}$ (TSP) or $PL = \bar{X} \pm 1.96\ SD$ (continuous).

Accuracy implies just that. How accurate is the instrument? It is established through independent audits by the Quality Assurance Section of AQB. Probability limits are calculated as with precision data. $PL = \bar{X} \pm 1.96\ SD$.

The EPA requires quarterly reports of the P&A data, as well as an annual SLAMS (State and Local Air Monitoring Sites) report which includes the P&A for SLAMS sites throughout the state.

Tables DI (Precision) and DII (Accuracy) summarize the P&A data by reporting agency and pollutant, quarterly and annually. Table DIII lists the audits performed in 1984 by site, giving dates and % difference.

Table DI

Precision TSP

Air Quality Bureau #001

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff.	- 2.04	- 1.18	+ 0.21	- 2.87	- 1.48
Std. Deviation (SD) % Diff.	7.05	11.10	9.82	7.20	8.88
Upper Prob. Limit (UPL)	+ 7.72	+14.20	+13.82	+ 7.10	+10.83
Lower Prob. Limit (LPL)	-11.80	-16.56	-13.40	-12.85	-13.79
No. of Data Pairs	44	39	44	44	171
No. Readings >20 µg	0	0	4	0	4
No. of Sites	17	17	17	17	17
No. of Collocated Sites	2	2	2	2	2

Yellowstone County #002

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff.	+ 6.38	+ 1.27	+ 4.16	- 1.02	+ 2.32
SD % Diff.	17.09	5.83	2.15	4.64	8.31
UPL	+30.06	+ 9.35	+ 7.15	+15.41	+18.60
LPL	-17.30	- 6.82	+ 1.18	- 7.45	-13.97
No. of Data Pairs	9	15	14	14	52
No. Readings >20 µg	0	4	0	0	4
No. of Sites	4	4	4	4	4
No. of Collo. Sites	1	1	1	1	1

Cascade County #003

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff.	+ 0.44	+ 0.37	- 6.56	- 5.81	- 3.19
SD % Diff	9.81	10.73	12.76	14.9	12.47
UPL	+14.03	+15.25	+11.13	+14.85	+14.10
LPL	-13.15	-14.50	-24.25	-26.47	-20.47
No. of Data Pairs	13	13	16	15	57
No. Readings >20 µg	0	2	4	2	8
No. of Sites	3	3	3	3	3
No. of Collo. Sites	1	1	1	1	1

Table DI, Cont.

Missoula County #004

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff.	+ 1.65	+ 1.00	+ 0.41	- 4.07	- 0.26
SD % Diff.	5.60	6.91	10.21	10.30	8.68
UPL	+ 9.42	+10.58	+14.56	+10.20	+11.77
LPL	- 6.12	- 8.58	-13.76	-18.34	-12.29
No. of Data Pairs	23	25	24	24	96
No. Readings >20 µg	0	0	8	0	8
No. of Sites	10	10	10	10	10
No. of Collo. Sites	1	1	1	1	1

Precision SO2

Air Quality Bureau #001 (SLAMS/NAMS)

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff.	+ 2.92	+ 1.75	- 1.20	+ 4.06	+ 2.00
SD % Diff.	3.24	6.42	4.62	5.56	5.34
UPL	+ 9.27	+14.34	+ 7.86	+14.94	+12.49
LPL	- 3.42	-10.84	-10.26	- 6.83	- 8.47
No. Checks	39	39	25	26	129
No. of Sites	3	3	2	2	3

Air Quality Bureau #001 (All Sites)

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff.	+ 2.92	+ 1.75	- 1.26	+ 3.33	+ 1.90
SD % Diff.	3.24	6.42	4.56	8.95	6.42
UPL	+ 9.27	+14.34	+ 7.68	+20.88	+14.48
LPL	- 3.42	-10.84	-10.20	-14.20	-10.68
No. Checks	39	39	28	38	144
No. of Sites	3	3	3	3	3

Precision CO

Yellowstone County #002

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff.	+ 4.50	+ 6.5	site discontinued		+ 4.64
SD % Diff.	1.95		4/7/86		1.95
UPL	+ 8.32				+ 8.45
LPL	+ 0.69				+ 0.82
No. Checks	14				15
No. of Sites	1				1

Cascade County #003

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff.	+ 0.28	+ 1.66	+ 1.57	+ 0.40	+ 0.97
SD % Diff.	2.15	1.52	1.64	1.44	1.77
UPL	+ 4.49	+ 4.63	+ 4.79	+ 3.21	+ 4.43
LPL	- 3.93	- 1.31	- 1.64	- 2.41	- 2.49
No. Checks	12	12	13	14	51
No. of Sites	1	1	1	1	1

Missoula County #004

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff.	+ 0.28	- 3.36	- 2.88	+ 2.51	- 0.48
SD % Diff.	4.31	5.35	12.09	5.63	7.21
UPL	+ 8.73	+ 7.14	+20.82	+13.55	+13.65
LPL	- 8.18	-13.85	-26.58	- 8.52	-14.60
No. Checks	16	17	12	22	67
No. of Sites	2	2	1	2	2

Precision Lead

Air Quality Bureau #001

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff.	- 1.31	+ 5.07	- 2.88	- 4.61	- 1.05
SD % Diff.	12.87	29.53	24.11	16.31	21.52
UPL	+16.53	+45.99	+30.53	+18.00	+28.77
LPL	-19.15	-35.85	-36.29	-27.21	-30.88
No. of Data Pairs	30	27	30	29	116
No. Readings >0.15 µg	2	1	6	2	11
No. of Sites	3	3	3	3	3
No. of Collo. Sites	1	1	1	1	1

Table DI, Cont.

Precision PM-10

Air Quality Bureau #001

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff.	+ 3.41	- 2.46	- 2.9	- 3.66	- 1.91
SD % Diff.	8.25	20.16	11.02	5.50	12.23
UPL	+14.84	+25.48	+12.37	+ 3.97	+15.05
LPL	- 8.02	-30.39	-18.17	-11.28	-18.86
No. Checks	17	21	32	27	97
No. Readings >0.20 µg	5	8	19	8	40
No. of Sites	12	12	12	12	12
No. of Collo. Sites	2	2	2	2	2

TABLE DII

Accuracy TSP

Air Quality Bureau #001 (SLAMS/NAMS)

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff.	- 1.65	- 0.69	- 1.30	- 0.88	- 1.19
SD % Diff.	2.82	1.55	1.90	3.11	2.28
UPL	+ 3.87	+ 2.34	+ 3.41	+ 5.31	+ 3.27
LPL	- 7.17	- 3.72	- 5.02	- 6.96	- 5.65
No. of Audits	10	8	29	12	59

Air Quality Bureau #001 (All Sites)

Avg. % Diff.	- 1.02	- 0.69	- 1.30	- 0.35	- 0.95
SD % Diff.	2.61	1.55	1.90	3.92	2.58
UPL	+ 4.10	+ 2.34	+ 3.41	+ 7.34	+ 4.10
LPL	- 6.14	- 3.72	- 5.02	- 8.04	- 6.00
No. of Audits	14	8	29	15	66

Yellowstone County #002

Avg. % Diff.	- 0.85	+ 0.30	+ 0.20	- 1.67	- 0.86
SD % Diff.	1.57	4.51	3.54	2.52	2.70
UPL	+ 2.22	+ 9.14	+ 7.13	+ 3.26	+ 4.43
LPL	- 3.92	- 8.54	- 6.73	- 6.60	- 6.16
No. of Audits	4	3	2	7	16

Cascade County #003

Avg. % Diff.	- 1.65	+ 0.10	+ 1.02	- 1.65	- 0.26
SD % Diff.	2.60	1.27	5.02	6.15	3.99
UPL	+ 3.44	+ 2.59	+10.85	+10.41	+ 7.57
LPL	- 6.74	- 2.39	- 8.82	-13.71	- 8.08
No. of Audits	4	2	6	2	14

Missoula County #004

Avg. % Diff.	+ 0.80	+ 0.40	- 0.23	- 3.50	- 0.86
SD % Diff.	3.18	2.29	1.03	4.93	3.75
UPL	+ 7.03	+ 4.89	+ 1.79	+ 6.07	+ 6.49
LPL	- 5.44	- 4.09	- 2.24	-13.24	- 8.21
No. of Audits	6	3	4	6	19

Accuracy AQB PM-10

Avg. % Diff.	- 4.05	- 6.52	- 2.65	- 6.60	- 4.70
SD % Diff.	3.73	4.13	1.77	5.26	2.99
UPL	+ 3.26	+ 1.57	+ 0.82	+ 3.71	+ 1.16
LPL	-11.36	-14.61	- 6.12	-16.91	-10.57
No. of Audits	6	6	8	5	25

TABLE DII, Cont.

Industry*

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff.	+ 5.38	- 0.10	+ 0.15	- 0.02	+ 0.59
SD % Diff.	6.43	4.62	3.23	4.01	4.52
UPL	+17.98	+ 8.96	+ 6.48	+ 7.83	+ 9.44
LPL	- 7.21	- 9.16	- 6.17	- 7.87	- 8.26
No. of Audits	6	14	13	22	55

Indian Reservations*

Avg. % Diff.	+ 1.52	---	- 2.80	- 0.67	- 0.65
SD % Diff.	2.64	---	3.29	0.81	3.23
UPL	+ 6.68	---	+ 3.64	+ 0.92	+ 5.68
LPL	- 3.65	---	- 9.24	- 2.25	- 6.98
No. of Audits	6	---	6	3	15

*Data by site available by request.

Lewis & Clark County

Avg. % Diff.	- 0.40	---	+ 3.6	- 1.25	+ 0.06
SD % Diff.	2.26	---	---	3.46	2.89
UPL	+ 4.03	---	---	+ 5.54	+ 5.73
LPL	- 4.83	---	---	- 8.04	- 5.61
No. of Audits	2	---	1	2	5

Accuracy AQB PM-10

Avg. % Diff.	- 4.05	- 6.52	- 2.65	- 6.60	- 4.70
SD % Diff.	3.73	4.13	1.77	5.26	2.99
UPL	+ 3.26	+ 1.57	+ 0.82	+ 3.71	+ 1.16
LPL	-11.36	-14.61	- 6.12	-16.91	-10.57
No. of Audits	6	6	8	5	25

Accuracy Missoula PM-10/15

Avg. % Diff.	- 1.58	- 5.2	- 1.3	- 4.00	- 2.38
SD % Diff.	6.09			17.82	7.60
UPL	+10.36			+30.93	+12.52
LPL	-13.52			-38.93	-17.28
No. of Audits	6	1	1	2	10

Accuracy SO2

Air Quality Bureau #001 (SLAMS/NAMS)

		Level 1	Level 2	Level 3	Level 4	Full Scale
1st Qtr.	Avg. % Diff.	- 4.40	- 2.13	- 1.57	- 6.93	- 6.30
	SD % Diff.	3.81	3.16	4.01	3.45	3.80
	UPL	+ 3.07	+ 4.07	+ 6.29	- 0.17	+ 1.16
	LPL	-11.87	- 8.34	- 9.42	-13.70	-13.76
	No. of Audits	3	3	3	3	3
2nd Qtr.	Avg. % Diff.	- 8.90	- 9.27	-11.50	- 8.30	- 8.70
	SD % Diff.	7.05	3.97	3.34	2.77	2.81
	UPL	+ 4.89	- 1.48	- 4.94	- 2.91	- 3.20
	LPL	-22.75	-17.05	-18.05	-13.76	-14.20
	No. of Audits	3	3	3	3	3
3rd Qtr.	Avg. % Diff.	- 2.20	+ 2.93	+ 3.93	+ 4.10	+ 4.28
	SD % Diff.	7.09	5.73	4.56	4.19	3.64
	UPL	+11.70	+14.16	+12.87	+12.32	+11.41
	LPL	-16.10	- 8.30	- 5.00	- 4.12	- 2.84
	No. of Audits	6	6	6	6	6
4th Qtr.	Avg. % Diff.	+30.00	+17.40	+11.25	+12.50	+11.75
	SD % Diff.	12.30	9.33	9.55	9.33	9.26
	UPL	+54.12	+35.69	+29.96	+30.79	+29.91
	LPL	+ 5.88	- 0.89	- 7.46	- 5.79	- 6.41
	No. of Audits	2	2	2	2	2
Annual	Avg. % Diff.	+ 0.49	+ 1.03	+ 0.44	+ 0.27	+ 0.30
	SD % Diff.	14.29	9.64	8.75	8.68	8.45
	UPL	+28.49	+20.19	+17.65	+17.28	+16.86
	LPL	-27.52	-17.59	-16.66	-16.74	-16.26
	No. of Audits	14	14	14	14	14

Air Quality Bureau #001 (All Sites)

1st Qtr.	Avg. % Diff.	- 4.40	- 2.13	- 1.57	- 6.93	- 6.30
	SD % Diff.	3.81	3.16	4.01	3.45	3.80
	UPL	+ 3.07	+ 4.07	+ 6.29	- 0.17	+ 1.16
	LPL	-11.87	- 8.34	- 9.42	-13.70	-13.76
	No. of Audits	3	3	3	3	3
2nd Qtr.	Avg. % Diff.	- 8.90	- 9.27	-11.50	- 8.30	- 8.70
	SD % Diff.	7.05	3.97	3.34	2.77	2.81
	UPL	+ 4.89	- 1.48	- 4.94	- 2.91	- 3.20
	LPL	-22.75	-17.05	-18.05	-13.76	-14.20
	No. of Audits	3	3	3	3	3

Table DII, Cont.

		Level 1	Level 2	Level 3	Level 4	Full Scale
3rd Qtr.	Avg. % Diff.	- 1.57	+ 3.74	+ 4.71	+ 4.10	+ 5.01
	SD % Diff.	6.67	5.65	4.65	4.19	3.84
	UPL	+11.53	+14.82	+13.82	+12.32	+12.54
	LPL	-14.68	- 7.33	- 4.39	- 4.12	- 2.51
	No. of Audits	7	7	7	7	7
4th Qtr.	Avg. % Diff.	+14.33	+ 9.55	+ 3.40	+12.50	+ 3.85
	SD % Diff.	20.42	10.59	11.02	9.33	10.88
	UPL	+54.35	+30.31	+25.00	+30.79	+25.18
	LPL	-25.70	-11.21	-18.20	- 5.79	-17.48
	No. of Audits	4	4	4	4	4
Annual	Avg. % Diff.	+ 0.37	+ 1.78	+ 0.44	+ 0.27	+ 0.32
	SD % Diff.	13.18	6.11	8.48	8.68	8.17
	UPL	+26.21	+13.75	+17.06	+17.28	+16.34
	LPL	-25.47	-10.20	-16.19	-16.74	-15.69
	No. of Audits	17	17	17	17	17

Accuracy CO

Yellowstone County #002

1st Qtr.	Avg. % Diff.	+ 0.2	- 1.3	- 5.1	---	- 5.0
	SD % Diff.	---	---	---	---	---
	UPL	---	---	---	---	---
	LPL	---	---	---	---	---
	No. of Audits	1	1	1	0	1

Site discontinued 4/7/86.

Cascade County #003

1st Qtr.	Avg. % Diff.	+ 6.4	- 3.6	- 7.5	---	- 7.6
	SD % Diff.	---	---	---	---	---
	UPL	---	---	---	---	---
	LPL	---	---	---	---	---
	No. of Audits	1	1	1	0	1
2nd Qtr.	Avg. % Diff.	+ 1.70	- 3.40	- 5.25	---	- 5.35
	SD % Diff.	6.65	0.28	3.18	---	3.18
	UPL	+14.73	- 2.85	+ 0.99	---	+ 0.89
	LPL	-11.33	- 3.95	-11.49	---	-11.59
	No. of Audits	1	1	1	0	1

Table DII, Cont.

		Level 1	Level 2	Level 3	Level 4	Full Scale
3rd Qtr.	Avg. % Diff.	+ 4.35	+ 1.05	- 0.05	---	0.00
	SD % Diff.	3.32	3.32	4.03	---	4.24
	UPL	+10.86	+ 7.56	+ 7.85	---	+ 8.32
	LPL	- 2.16	- 5.46	- 7.95	---	- 8.32
	No. of Audits	2	2	2	0	2
4th Qtr.	Avg. % Diff.	+ 5.13	+ 2.40	+ 1.03	---	+ 0.90
	SD % Diff.	2.71	3.32	3.41	---	3.38
	UPL	+10.45	+ 8.90	+ 7.72	---	+ 7.53
	LPL	- 0.19	- 4.10	- 5.65	---	- 5.73
	No. of Audits	1	1	1	0	1
Annual	Avg. % Diff.	+ 3.76	+ 0.08	- 1.48	---	- 1.60
	SD % Diff.	4.27	3.95	4.49	---	4.47
	UPL	+12.14	+ 7.82	+ 7.33	---	+ 7.16
	LPL	- 4.62	- 7.66	-10.29	---	-10.36
	No. of Audits	5	5	5	0	5
Missoula County #004						
1st Qtr.	Avg. % Diff.	- 1.30	- 1.00	- 1.90	---	- 1.95
	SD % Diff.	5.94	2.83	5.80	---	5.16
	UPL	+10.34	+ 4.54	+ 9.46	---	+ 8.17
	LPL	-12.94	- 6.54	-13.26	---	-12.07
	No. of Audits	2	2	2	0	2
2nd Qtr.	Avg. % Diff.	+ 0.47	+ 0.63	+ 0.97	---	+ 0.77
	SD % Diff.	5.20	3.46	6.44	---	5.96
	UPL	+10.65	+ 7.42	+13.59	---	+12.44
	LPL	- 9.72	- 6.16	-11.65	---	-10.91
	No. of Audits	1	1	1	0	1
3rd Qtr.	Avg. % Diff.	+ 7.25	+ 7.75	+11.76	---	+11.00
	SD % Diff.	4.17	2.05	3.20	---	3.39
	UPL	+15.43	+11.77	+18.02		+17.65
	LPL	- 0.90	+ 3.73	+ 5.50	---	+ 4.35
	No. of Audits	2	2	2	0	2
4th Qtr.	Avg. % Diff.	+ 3.65	+ 0.80	- 0.95	---	+ 0.05
	SD % Diff.	3.04	0.42	2.05	---	0.92
	UPL	+ 9.61	+ 1.63	+ 3.07	---	+ 1.85
	LPL	- 2.31	- 0.03	- 4.97	---	- 1.75
	No. of Audits	2	2	2	0	2

Table DII, Cont.

		Level 1	Level 2	Level 3	Level 4	Full Scale
Annual	Avg. % Diff.	+ 3.31	+ 2.57	+ 3.50	---	+ 3.49
	SD % Diff.	4.76	4.18	6.98	---	6.35
	UPL	+12.65	+10.76	+17.19	---	+15.93
	LPL	- 6.02	- 5.62	-10.19	---	- 8.96
	No. of Audits	7	7	7	0	7

Accuracy Lead

Air Quality Bureau #001 (SLAMS/NAMS)

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff.	- 2.85	+ 1.05	- 2.45	- 2.08	- 1.87
SD % Diff.	3.71	0.64	0.07	1.70	2.56
UPL	+ 4.47	+ 2.30	- 2.31	+ 1.26	+ 3.14
LPL	-10.11	- 0.20	- 2.59	- 5.40	- 6.89
No. of Audits	4	2	2	4	12

TABLE DIII

TSP Site/Audit List

Site Name	SAROAD #	Date	% Diff
Billings - City Hall Rptg	0080 008 G01	3-4-86	-0.6 %
		5-20-86	-4.9 %
		10-2-86	+0.9 %
		12-2-86	+1.9 %
Billings - City Hall Collo	0080 008 G07	3-4-86	+0.4 %
		5-20-86	+2.7 %
		10-2-86	-4.7 %
		12-2-86	1.3 %
Billings - Sandstone School	0080 067 G01	12-3-86	-0.8 %
Billings - Grand Avenue	0080 009 G01	3-4-86	-4.2 %
		5-19-86	+3.1 %
		8-11-86	-0.4 %
		12-3-86	0.2 %
Billings - Grand Ave PM-10	0080 009 G01	8-11-86	12.1 %
		12-3-86	11.4 %
Billings - Lockwood Park	0080 065 F01	3-3-86	+2.8 %
		5-19-86	+0.4 %
		9-30-86	-3.4 %
		12-2-86	-1.2 %
Bozeman - Hawthorne School West		3-5-86	+0.5 %
Bozeman - Hawthorne School East		3-5-86	0.6 %
BOZEMAN - CITY BUILDING TSP	0120 002 F01	2-22-86	-0.8 %
		10-28-86	-1.6 %
Bozeman - City Building PM-10	0120 002 F05	2-22-86	-6.5 %
		11-5-86	8.4 %
Bozeman - Christie Fields	0120 007 F01	3-5-86	-1.7 %
Butte - Greeley School	0160 005 F01	1-24-86	-0.9 %
		11-18-86	-3.7 %
Butte - Greeley School PM-10	0160 005 F05	11-13-86	-1.3 %
ANACONDA - KURIUM STORAGE	0400 712 J02	11-18-86	2.6 %
Anaconda - Wolfe Residence	0400 713 J02	11-18-86	-1.8 %
Columbia Falls - Jr High TSP	0270 003 F01	8-25-86	-4.5 %
Columbia Falls - Jr High PM-10	0270 003 F01	8-25-86	5.0 %

TABLE DIII, Cont.

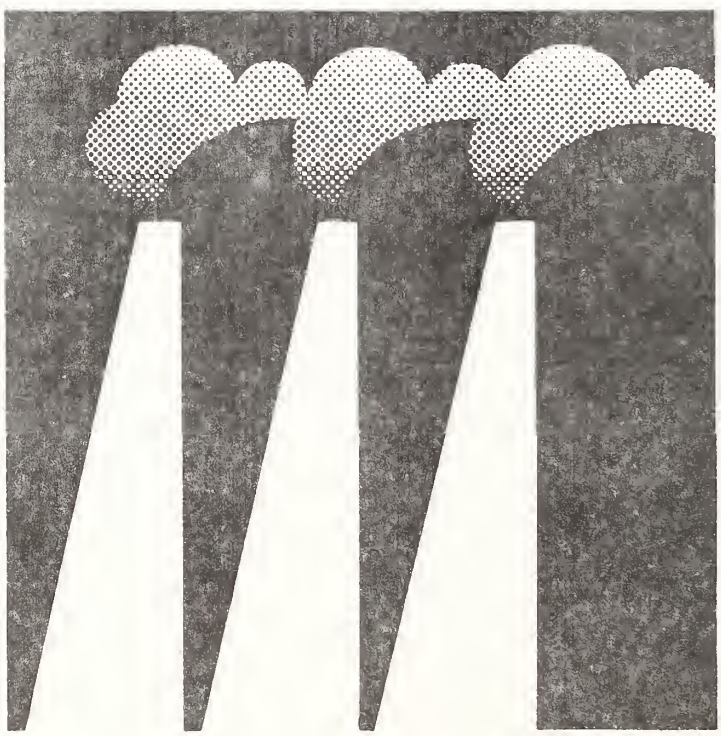
Site Name	SAROAD #	Date	% Diff
Columbia Falls - Anders Residence	0270 005 F01	8-25-86	+0.1 %
Deer Lodge - Powell Co. Courthouse	0380 001 F01	6-26-86	+1.5 %
Dillon - Beaverhead Co Courthouse	0420 001 F01	6-26-86	-0.6 %
East Helena - Hastie	0860 002 F02	1-15-86	+0.0 %
East Helena - Firehall	0860 714 F02	5-6-86	+0.6 %
		11-3-86	-1.2 %
East Helena - Hadfield West	0860 719 F02	2-27-86	-2.4 %
		7-9-86	-2.6 %
		11-3-86	-0.5 %
East Helena - Hadfield East	0860 719 F07	2-27-86	-0.8 %
		7-9-86	-2.4 %
		11-3-86	-0.8 %
East Helena - Dartman Field	0860 724 F02	2-27-86	-8.2 %
Eureka - Lincoln Electric Co-op		8-26-86	+1.3 %
Hamilton - Ravalli Co. Courthouse	1300 001 F01	4-22-86	-2.1 %
		9-19-86	-0.7 %
Hamilton - Ravalli Co. Cths. PM-10	1300 001 F05	9-19-86	-3.5 %
Great Falls - Black Eagle Post Office	0660 019 G01	9-12-86	+3.9 %
Great Falls - Fire Station No. 1	0060 009 G01	3-11-86	-4.5 %
		9-12-86	-3.7 %
Great Falls - Library East	0660 017 G07	3-11-86	+2.8 %
		5-30-86	-0.8 %
		9-12-86	+9.6 %
		12-17-86	+1.9 %
Great Falls - Library West	0660 017 G01	3-11-86	+0.8 %
		5-30-86	+1.0 %
		9-12-86	-0.8 %
		12-17-86	+1.3 %
Great Falls - Library PM-10	0660 017 G01	3-11-86	-13.6 %
		6-17-86	-5.1 %
		9-12-86	-3.2 %
Helena - Capital Courts	0720 013 G05	7-16-86	+3.6 %
Helena Valley - L & C Co.		12-31-86	+1.2 %
Helena - Cogswell Building TSP	0720 001 F01	8-4-86	-1.1 %

TABLE DIII, Cont.

Site Name	SAROAD #	Date	% Diff
Helena - Coqswell PM-10 Reporting		3-13-86	+2.8 %
		8-4-86	+2.9 %
Helena - Coqswell PM-10 Collocated		3-13-86	+2.8 %
		8-4-86	+4.3 %
Helena - Phillips Lane PM-10	0860 009 F01	12-31-86	-2.5 %
Helena - Independent Record - L & C Co		1-9-86	-1.2 %
Helena (R PM-10 - L & C Co		1-9-86	-0.3 %
Helena Valley PM-10 L&C Co		12-31-86	-3.8 %
Glacier Nat Park - St Mary's	0570 010 F02	1-7-86	+2.0 %
Glacier Nat Park - West Glacier	0570 007 F02	1-7-86	+0.3 %
Kalispell - Universal Athletics (UA)	0800 015 F01	6-13-86	1.2 %
		8-27-86	+0.5 %
		11-7-86	-1.6 %
Kalispell - UA PM-10	0800 015 F01	6-13-86	-1.3 %
		8-27-86	-1.4 %
		11-7-86	-6.3 %
KALISPELL - PETERSON SCHOOL		11-7-86	+2.3 %
Laurel - Jr High	0840 001 F01	3-5-86	+1.6 %
Libby - Lincoln Co Courthouse Reporting	0900 012 F01	8-26-86	+2.1 %
Libby - Linclon Co Courthouse Collocated	0900 012 F07	8-26-86	+0.6 %
Libby Courthouse PM-10 Reporting		3-13-86	+2.8 %
		8-26-86	+0.3 %
Libby - Lincoln Co Courthouse PM-10 Coll	0900 012 F07	8-26-86	-1.4 %
Missoula - Meadow Hills School	1100 029 G01	3-26-86	-3.0 %
Missoula - Boyd Park SW	1100 024 G01	6-23-86	-0.1 %
		9-19-86	-0.8 %
Missoula - Boyd Park PM-10 E	1100 024 G01	3-18-86	+7.3 %
		6-23-86	-5.0 %
		9-19-86	-1.3 %
Missoula - Health PM 10	1100 031 G01	3-18-86	+2.5 %
		9-26-86	-1.3 %
Missoula - Rose Park R	1100 020 G01	3-26-86	+0.7 %

TABLE DIII, Cont.

Site Name	SAROAD #	Date	% Diff
Missoula - Rose Park PM-10 R	1100 020 G01	3-18-86	-9.4 %
Missoula - Rose Park PM-10 L	1100 020 G01	3-18-86	-0.3 %
Missoula - Health NE	1100 031 G01	6-23-86	-2.0 %
		9-26-86	+0.2 %
Missoula - Health SW	1100 031 G01	3-26-86	-1.2 %
Missoula - Health Collo	1100 031 G07	3-26-86	-1.2 %
		6-23-86	+3.6 %
Missoula - Rattlesnake	1100 032 G01	6-24-86	-1.2 %
Missoula - Stone Container #1	1100 015 G02	3-18-86	+6.1 %
Missoula - Stone Container #1 Collo	1100 015 G07	3-18-86	+2.7 %
Missoula - Stone Container #2	1100 016 G02	3-18-86	-1.6 %
Ovando - Smith Ranch	1260 024 F03	6-12-86	-3.3 %
Ovando - Smith Ranch PM-10	1260 024 F03	6-12-86	-4.7 %
Sidney - City Hall	1320 010 F01	1-29-86	-1.1 %
Thompson Falls - Sanders Co Courthouse	1400 003 F01	6-23-86	-0.8 %
Thompson Falls - Sanders Co Cths PM-10	1400 003 F01	6-23-86	-5.0 %
Scobey - Harleneee Ranch	0340 010 F05	12-16-86	+9.6 %



APPENDIX E

List of Air Quality Publications

APPENDIX E

LIST OF AIR QUALITY PUBLICATIONS

State of Montana Air Quality Rules (July, 1984)

Clean Air Act of Montana (November, 1984)

Montana Air Quality Data and Information Summary for 1986 (December, 1987)

1981 Network Review (November, 1981)

1982 Network Review (April, 1982)

1983 Network Review (September, 1983)

1984 Network Review (December, 1984)

1985 Network Review (August, 1985)

1986 Network Review (September, 1986)

Coefield, J. et al. Flathead River Basin Environmental Impact Study - Interim Annual Report for July 1979 through September 1980 (June, 1980).

Coefield, J. et al. Flathead River Basin Environmental Impact Study - Interim Annual Report for September 1980 to December 1981 (May, 1983).

Coefield, J.; Raisch, R. Flathead River Basin Environmental Impact Study - Air Resource Final Report (November, 1983).

Erickson, R.; Tomlinson, W.; Steffel, R.; Baxter, T. Survey of Residential Wood Use in Helena, Bozeman, Great Falls, and Kalispell, Montana (June, 1981).

Houck, J. et al. East Helena Source Apportionment Study (Sept. 1982).

McAllister, D.; Ruby, M.; Vichorek, D.; Crowley, F. Final Environmental Impact Study, Montana Ambient Air Quality Standards Study (February, 1980).

Olsen, J.; Schneider, J. Montana Air Quality Data and Information Summary for 1982 (September, 1983).

Raisch, R.; Boschee, R. Geographical Distribution of Sulfur Dioxide in the Vicinity of Billings, Montana (April, 1987).

Raisch, R.; Sternberg, S.; Schneider, J. Montana Air Quality Data and Information Summary for 1981 (September, 1982).

Robbins, H., et al. Montana Quality Assurance Manual (December, 1980).

Rockwell Int. et al. Final Report for Laurel-Billings SO_2 Study, 1982.

Sternberg, S. Montana Air Quality Data and Information Summary for 1979-1980 (August, 1981).

Sternberg, S. Montana Air Quality Data and Information Summary for 1983 (January, 1985).

Sternberg, S. Montana Air Quality Data and Information Summary for 1984 (July, 1985)

Sternberg, S. Montana Air Quality Data and Information Summary for 1985 (September, 1986)

Sternberg, S. Billings SO_2 Study, Data Analysis, Model Validation, and Source Determination (April, 1984)

Zimmerman, Larry, et al. Montana Smoke Management Plan Annual Report, Fall Season 1986 (1987).

APPENDIX E

LIST OF MAPS TECHNICAL REPORTS

Health Effects

1. Johnson, K; Schwaller, R; Wing, B. et al. Pulmonary Function Testing of Patients with Chronic Obstructive Pulmonary Disease (September 1979).

2. Johnson, K.; Gideon, R.; Loftsgaarden, D.; Wing, B. et al. Pulmonary Function Testing of Elementary School Children (October 1979).

3. Johnson, K.; Gideon, R.; Loftsgaarden, D.; Medvec, S.; Simms, M. et al. Relationship Between Human Health and Inhalable Particulates (October 1980).

4. Warren, G.; Rogers, S.; and Medvec, S. Mutagen Screening in an Isolated High Lung Cancer Mortality Area of Montana (June 1979).

Air Quality

1. Gelhaus, J., Air Quality Data Summaries for Anaconda-Butte, Billings, Missoula, and Columbia Falls/Hardin/East Helena/Colstrip (February 1981).

2. Robbins, H.; Driscoll, P.; Myren, B. et al. Air Monitoring Instrumentation (October 1979).

Meteorology/Modeling

1. Gelhaus, J. et al. Meteorological Summary - First Year (July 1979).

2. Gelhaus, J. and Harner, S. Deer Lodge Valley Dispersion Study (July 1979).

3. Gelhaus, J. Meteorological Summary - Billings (February 1981).

4. Gelhaus, J., Machler, M., and Stewart, T. Montana Air Resources Modeling System (August 1979).

5. Middlemist, T.; Robbins, H; and Zimmerman, L. Missoula Valley Dispersion Study (September 1980).

6. Nelson, B.; Machler, M; and Robbins, H. Deer Lodge Valley Dispersion Study (October, 1980)

Emission Inventory

1. Bohn, R.; Cowherd, C.; Keller, R; and Raisch, R. Update and Improvement of the Emission Inventory for MAPS Study Areas (November 1979).

2. Raisch, R.; Williams, G.; Bohn, R.; and Cowherd, C. A Study of the Feasibility of Performing an Inventory of Historical Emissions at Butte and Anaconda, Montana (November 1979).

Systems Design

1. Lynn, D. et al. Computer Information System Development (November 1979).

APPENDIX F

Point Source Emission Estimates

APPENDIX F

POINT SOURCE EMISSION ESTIMATES - 1986*

The following two tables list emission estimates from various industrial sources in the state. Table AP-F-I lists sulfur dioxide emissions; Table AP-F-II lists particulates.

TABLE AP-F-I

POINT SOURCE SULFUR DIOXIDE EMISSION ESTIMATES - 1986

AQCR	Source	SO2 Tons/Yr	County
140	East Decker Coal	31	Big Horn
	Westmoreland Resources	14	Big Horn
	Spring Creek Coal	9	Big Horn
	West Decker Coal	22	Big Horn
	Western Sugar	261	Yellowstone
	Continental Oil Co. (CONOCO)	3034	Yellowstone
	Farmers' Union CENEX	8357	Yellowstone
	Exxon Co., USA	13492	Yellowstone
	Montana Sulfur	2578	Yellowstone
	Montana Power Co. (Corette)	6759	Yellowstone
141	Montana Refining Co.	1186	Cascade
	United Materials	1	Cascade
	Unocal	192	Glacier
	Gypsy Highview	76	Glacier
	Northern Montana Gas	314	Toole
142	Stoltze Land & Lumber/Dillon	1	Beaverhead
	Continental Lime	12	Broadwater
	Pioneer Ready Mix	3	Gallatin
	A.E. Montana	3	Gallatin
	Plum Creek/Belgrade	1	Gallatin
	Ideal Basic Industries	15	Gallatin
	Ash Grove Cement West	327	Jefferson
	Golden Sunlight Mine	4	Jefferson
	ASARCO, Inc.	26197	Lewis & Clark
	American Chemet	4	Lewis & Clark
	Helena Sand & Gravel	1	Lewis & Clark
	Park Co. Incinerator	20	Park
	Louisiana Pacific/Deer Lodge	1	Powell
	Stauffer Chemical/Ramsay	1435	Silver Bow
143	Fisher Sand & Gravel	2	Dawson
	ANR Stateline Gas Plant	857	Richland
	Holly Sugar	72	Richland

*Due to varying inspection schedules, the estimates do not necessarily reflect 1986 data; however, these are the most current emission estimates available.

TABLE AP-F-I (cont.)

POINT SOURCE SULFUR DIOXIDE EMISSION ESTIMATES - 1986

AQCR	Source	SO2 Tons/Yr	County
143	Montana Dakota Utilities	1456	Richland
	Knife River Coal	1	Richland
	Kenco Refinery, Inc.	55	Roosevelt
	Peabody Coal	8	Rosebud
	Montana Power Colstrip 1 & 2	6728	Rosebud
	Western Energy Coal	39	Rosebud
	Montana Power Colstrip 3 & 4	1383	Rosebud
144	Plum Creek/Evergreen	5	Flathead
	Plum Creek/Columbia Falls	8	Flathead
	Stoltze Land & Lbr./Col. Falls	3	Flathead
	Columbia Falls Aluminum	1775	Flathead
	American Asphalt, Inc.	2	Flathead
	Pack & Company	1	Flathead
	Flathead County Asphalt	1	Flathead
	Plum Creek/Pablo	11	Lake
	Plum Creek/Ksanka	2	Lincoln
	Champion/Libby	13	Lincoln
	W. R. Grace	46	Lincoln
	DAW Forest Products	3	Mineral
	Champion/Bonner	22	Missoula
	Louisiana Pacific Particleboard	3	Missoula
	Champion Intermountain	1	Missoula
	Pyramid Mountain Lumber	1	Missoula
	Stone Container	165	Missoula
	Western Materials	1	Missoula
	Missoula White Pine	2	Missoula
	American Asphalt	2	Missoula
	Darby Lumber	2	Ravalli

Table AP-F-II

POINT SOURCE PARTICULATE EMISSION ESTIMATES - 1986*

TSP Emissions

AQCR	Source	Part. Tons/Yr	County
140	East Decker Coal	863	Big Horn
	Westmoreland Resources	341	Big Horn
	Spring Creek Coal	587	Bighorn
	West Decker Coal	885	Bighorn
	U.S. Gypsum	17	Fergus
	Century Paving	3	Fergus
	Spring Creek Forest Products	53	Wheatland
	Midland Materials	18	Yellowstone
	Barry O'Leary Co.	8	Yellowstone
	Cereal Foods Processors	206	Yellowstone
	Western Sugar	271	Yellowstone
	Empire Sand & Gravel	3	Yellowstone
	Continental Oil Co. (CONOCO)	180	Yellowstone
	Farmers Union (CENEX)	805	Yellowstone
	Exxon Co. USA	520	Yellowstone
	Montana Power Co./Corette	1374	Yellowstone
141	Interstate Specialties	9	Cascade
	General Mills	40	Cascade
	Montana Refining	8	Cascade
	Big Sky Feed & Supply	2	Cascade
	Robinson Insulation	2	Cascade
	Harvest States Coop	42	Cascade
	Great Falls City Asphalt Plant	6	Cascade
	United Materials	8	Cascade
	Conagra Feed	9	Cascade
	Cereal Food Processors	63	Cascade
	GTA Feeds	70	Cascade
142	Stoltze Land and Lumber/Dillon	144	Beaverhead
	Pfizer, Inc.	131	Beaverhead
	Continental Lime	88	Broadwater
	Rocky Mountain Crushing	30	Deer Lodge
	Pioneer Ready Mix	373	Gallatin
	A.E. Montana	35	Gallatin
	Plum Creek/Belgrade	50	Gallatin
	Ideal Basic Industries	165	Gallatin
	Cyprus Ind. Minerals	67	Gallatin
	Kanta Products	22	Gallatin
	Ash Grove Cement West	1543	Jefferson
	Golden Sunlight Mine	262	Jefferson
	ASARCO, Inc.	644	Lewis & Clark

*Due to varying inspection schedules, the estimates do not necessarily reflect 1986 data; however, these are the most current emission estimates available.

Table AP-F-II (cont.)

POINT SOURCE PARTICULATE EMISSION ESTIMATES - 1986

TSP Emissions

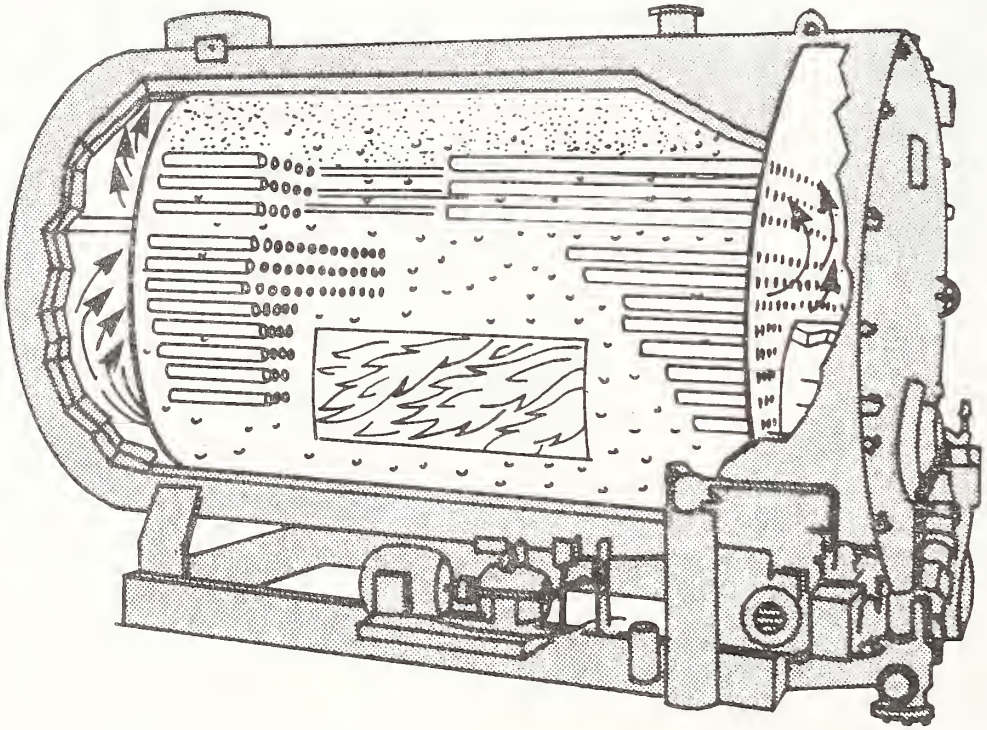
AQCR	Source	Part. Tons/Yr	County
142	American Chemet	21	Lewis & Clark
	Helena Sand & Gravel	36	Lewis & Clark
	Yellowstone Mine - Cyprus	226	Madison
	Alcotech Inc.	23	Meagher
	Brand S Lumber	108	Park
	Park County Incinerator	5	Park
	Park Lumber	11	Park
	Cominco	102	Powell
	Louisiana Pacific/Deer Lodge	59	Powell
	Stauffer Chemical/Ramsay	127	Silver Bow
	Butte-Silver Bow Asphalt	1	Silver Bow
	Gilman Excavating	12	Silver Bow
143	Peavey/Miles City	53	Custer
	Peavey/Glendive	13	Dawson
	Fisher Sand and Gravel	187	Dawson
	Zortman Mining Co.	179	Phillips
	Landusky Mining Co.	304	Phillips
	Holly Sugar	105	Richland
	Montana-Dakota Utilities	407	Richland
	Knife River Coal	127	Richland
	Kenco Refinery, Inc.	2	Roosevelt
	Peabody Coal	415	Rosebud
	Montana Power/Colstrip 1 & 2	1110	Rosebud
	Western Energy	3136	Rosebud
	Montana Power/Colstrip 3	799	Rosebud
144	Plum Creek/Evergreen	80	Flathead
	Klinger Lumber	15	Flathead
	Plum Creek Lumber/Columbia Falls	620	Flathead
	Stoltze Land & Lumber/Col. Falls	230	Flathead
	Columbia Falls Aluminum	31	Flathead
	American Asphalt/Flathead Co.	55	Flathead
	Pack and Company	54	Flathead
	Flathead County Asphalt	44	Flathead
	City of Kalispell Asphalt Plant	1	Flathead
	B & J Lumber/Montana Mokko	21	Flathead
	Flathead Lumber	225	Lake
	Plum Creek/Pablo	238	Lake
	Owens and Hurst	15	Lincoln
	Plum Creek/Ksanka	85	Lincoln
	ASARCO/Troy	84	Lincoln
	Champion/Libby	216	Lincoln
	W.R. Grace	114	Lincoln
	DAW Forest Products	53	Mineral
	Northwestern Lumber and Cedar	2	Mineral

Table AP-F-II (cont.)

POINT SOURCE PARTICULATE EMISSION ESTIMATES - 1986

TSP Emissions

AQCR	Source	Part. Tons/Yr	County
144	Champion/Bonner	414	Missoula
	Louisiana Pacific - Particleboard	476	Missoula
	Champion/Intermountain	76	Missoula
	Pyramid Mountain Lumber	63	Missoula
	Stone Container	748	Missoula
	Western Materials	26	Missoula
	Missoula White Pine	153	Missoula
	American Asphalt/Missoula Co.	53	Missoula
	City of Missoula Asphalt Plant	1	Missoula
	Missoula County Asphalt Plant	3	Missoula
	Nicholson Paving	44	Missoula
	Stoltze-Conner Lumber	97	Ravalli
	Darby Lumber	42	Ravalli
	Flodin Lumber	91	Sanders
	W. I. Forest Prod. Inc.	135	Sanders
	Watters Brother Lumber	4	Sanders



APPENDIX G

Prevention of Significant Deterioration

APPENDIX G

PREVENTION OF SIGNIFICANT DETERIORATION

Prevention of Significant Deterioration (PSD) requirements were first introduced as part of the 1977 Amendments to the Clean Air Act.

These PSD requirements set limits for increases in ambient pollution levels and established a system for preconstruction review of new major sources. Three PSD classes have been established. Class I allows very small increases in pollution; Class II allows somewhat larger increases; and Class III allows the air quality to "deteriorate" considerably more. In general, Class I is designed for "pristine" areas where almost any deterioration would be significant. Congress established several types of mandatory Class I areas. These mandatory areas include international parks, wilderness areas larger than 5000 acres, national memorial parks larger than 5000 acres, and existing national parks larger than 6000 acres. All other areas of the country classified as attainment are Class II. Class II limits allow for moderate, well-controlled growth and Class III limits allow pollutant levels to increase considerably.

Table AP-G-I shows the allowable increases for the various classes. Table AP-G-II lists the federal Class I areas for Montana and Figure AP-1-G shows the locations of these areas on a map of Montana.

In 1978 the state of Montana established its own PSD rules. These rules were closely patterned after the federal rules. In 1979 the EPA was sued by the Alabama Power Company over the federal PSD rules. The court ruled that EPA had misinterpreted the intent of Congress. As a result the EPA rewrote their rules, which then differed from Montana's

rules. The significant difference between the two sets of rules is that the state counted fugitive dust and uncontrolled plant emissions as part of the increment consumption.

Since 1979 the Air Quality Bureau has proceeded with rule-making to adopt an amended PSD rule which resembles the modified EPA rule. Final adoption of the Montana rule occurred January 28, 1983. EPA approved the new rule June 6, 1983, and delegated the entire responsibility for PSD to the state of Montana.

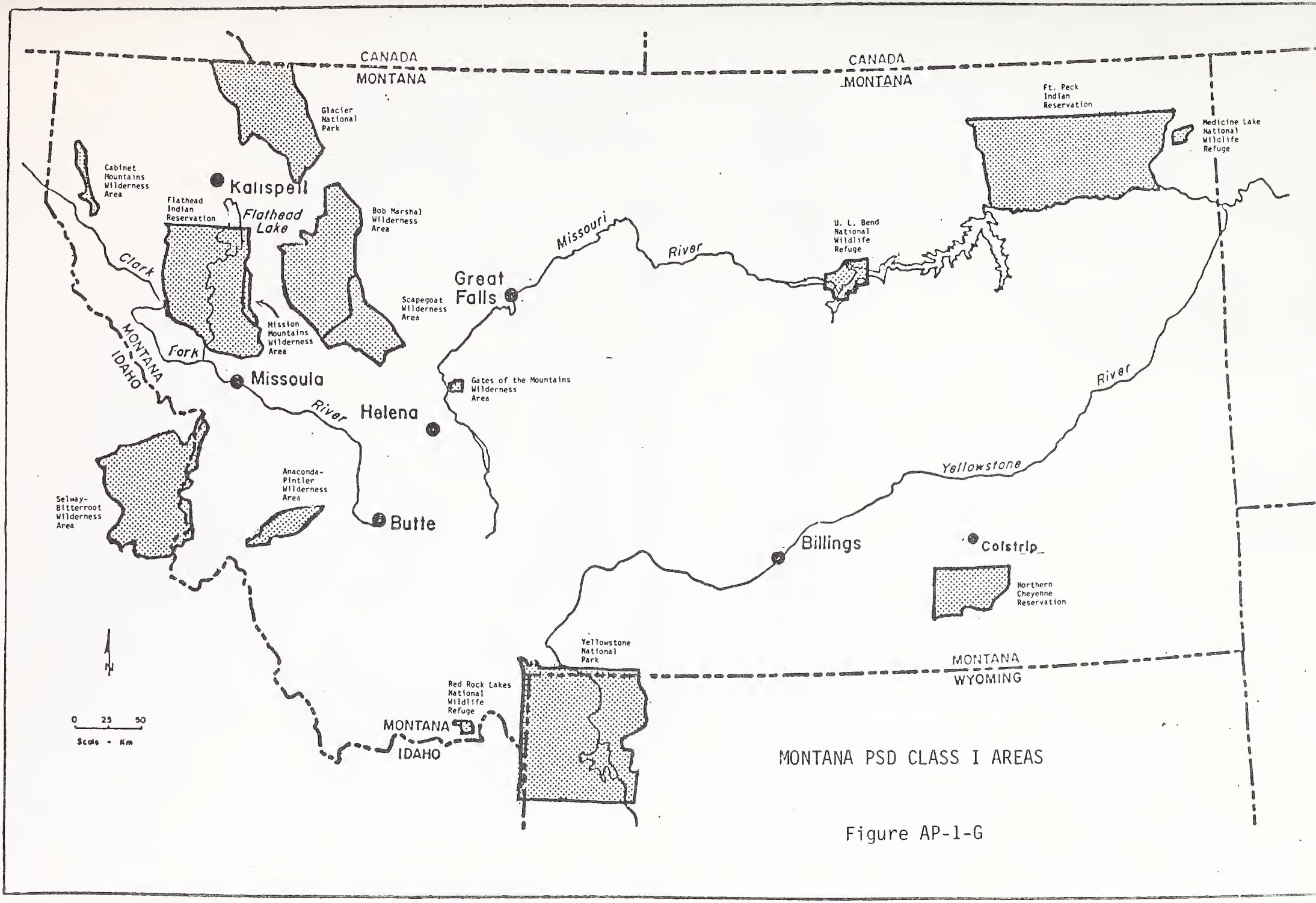
Table AP-G-I
FEDERAL PREVENTION OF SIGNIFICANT DETERIORATION
ALLOWABLE INCREMENTS
Micrograms Per Cubic Meter

	I	II	III	Not to exceed
Particulates				
Annual Geo. Mean	5	19	37	75
Maximum 24-hour	10	37	75	150
Sulfur Dioxide				
Annual Arith. Mean	2	20	40	80
Maximum 24-hour	5	91	182	365
Maximum 3-hour	25	512	700	1300

Table AP-G-II

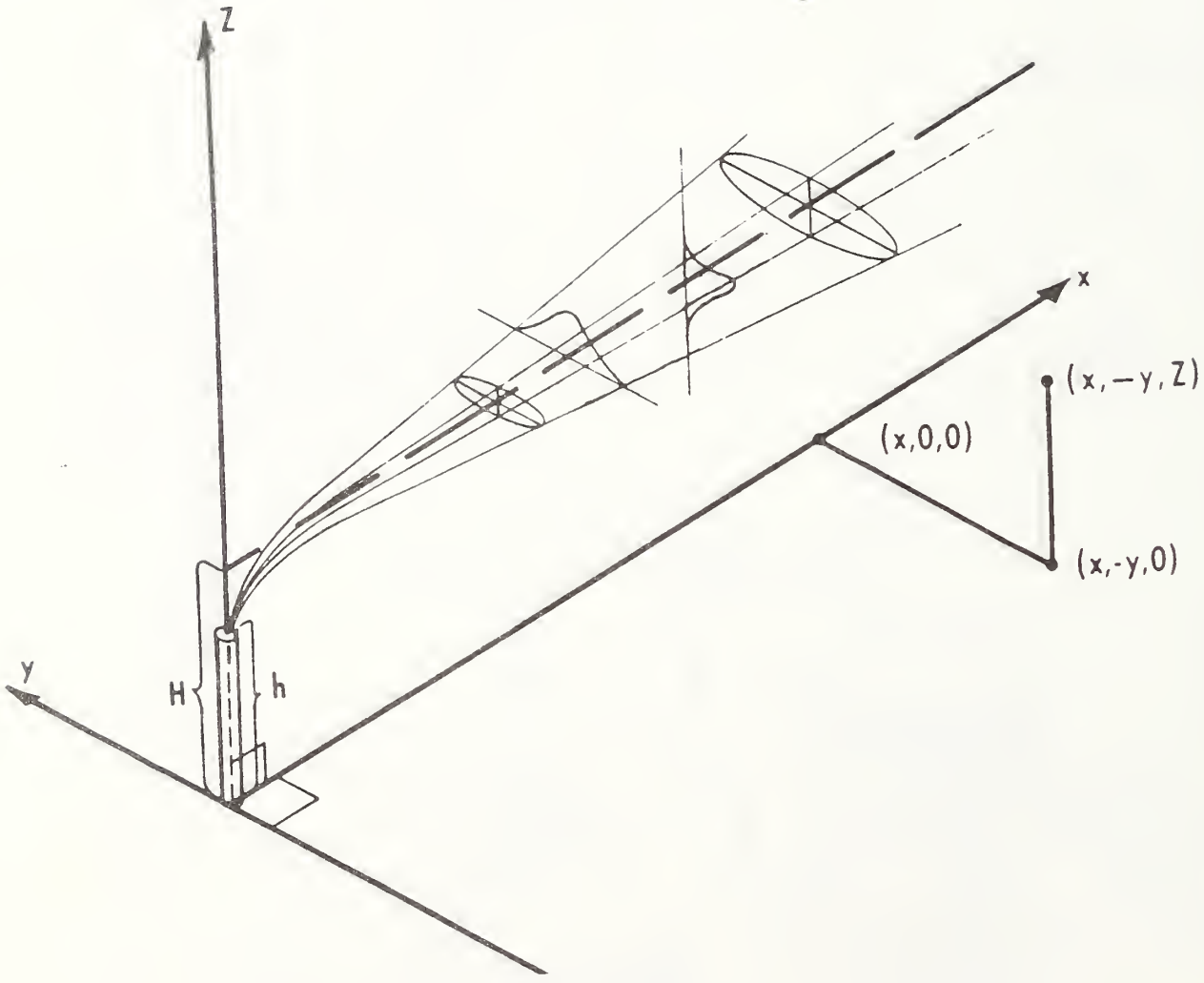
MONTANA FEDERAL CLASS I AREAS

Area	Location
Glacier National Park	NE Kalispell
Yellowstone National Park	S Bozeman
Bob Marshall Wilderness Area	SE Kalispell
Anaconda-Pintlar Wilderness Area	SW Anaconda
Selway-Bitterroot Wilderness Area	W Hamilton
Cabinet Mountains Wilderness Area	S Libby
Scapegoat Wilderness Area	NW Helena
Gates of the Mountains Wilderness Area	NE Helena
Mission Mountains Wilderness Area	SE Polson
Red Rock Lakes National Wildlife Refuge	S Virginia City
Medicine Lake National Wildlife Refuge	S Plentywood
U. L. Bend National Wildlife Refuge	SW Glasgow
Northern Cheyenne Reservation	SE Hardin
Flathead Indian Reservation	Near Polson & Ronan
Fort Peck Indian Reservation	N Wolf Point



MONTANA PSD CLASS I AREAS

Figure AP-1-G


Z
x
(x,−y,Z)
(x,0,0)
(x,-y,0)
y
H
h

APPENDIX H

Air Quality Data Reports

APPENDIX H

AIR QUALITY DATA REPORTS

This appendix presents the various air quality data reports that can be generated by the department.

The department uses EPA's Comprehensive Data Handling System (CDHS). This system has two sub-systems: Air Quality Data Handling System (AQDHS) and Emission Inventory System/Point Source (EIS/P&S).

The following reports have been generated by AQDHS programs.

AQDHS - Detail List - Daily

AP-1-H East Helena - Firehall Lead - 1986
AP-2-H Helena - Cogswell Building - TSP - 1986
AP-3-H Missoula - Rose Park - TSP - 1986

AQDHS - Detail List - Hourly

AP-4-H Billings - Coburn Road - SO_2 - November 1986
AP-5-H Great Falls - Pardis Clinic - CO - October 1986

AQDHS - Statistical Analysis by Month

AP-6-H East Helena - Firehall - 1986
AP-7-H Billings - Lockwood Park - 1986

AQDHS - Statistical Analysis by Year

AP-8-H Billings - Lockwood Park - 1986
AP-9-H Scobey - Marlenee Ranch - 1986

AQDHS - Standards Report

AP-10-H Libby - Lincoln County Courthouse - TSP - 1986
AP-11-H East Helena - Hadfield - Lead - 1986

AQCR: 142 AGENCY(F): STATE
CNTY: 0660 PROJECT(02): SOURCE-ORIENTED AMBIENT SURV.
AREA: 0660 PARM(12128): LEAD
SITE: 714 UNITS(01): MICROGRAMS/CUBIC METER
YEAR: 1986
LOCALE: FIREHALL - 2 EAST PACIFIC ST EAST HELENA LEWIS & CLARK

COLLECT METH: HI-VOL
ANALYSIS METH: EMISSION SPECTRA ICAP
SAMPLING INTR: DAILY
SAROAD KEY: 27/0860/714/F/02
MINIMUM DETEC: .01

SLAMS/NAMS(2): SLAMS
RPT AGNCY/SMSA: / 0000
UTM ZONE: 12
UTM EASTING: 429.4800
UTM NORTHING: 5159.6700
TIME ZONE(05): MOUNTAIN

PRIMARY
FEDERAL STANDARD 1.5 MICROGRAMS/CUBIC METER-CALENDAR MEAN
STATE STANDARD 1.5 MICROGRAMS/CUBIC METER-90 DAY MEAN

SECONDARY

MONTH

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	NO.	MEAN	MAX
01		1.86				3.52	2.32				3.69		4	2.853	3.69
02	4.97			0.55	2.38				1.13	0.09			5	1.864	4.97
03			4.14					3.81					2	3.975	4.14
04		3.08				2.42	0.24				7.59	6.24	5	3.914	7.59
05	3.27			3.40	0.44				0.43	1.55			5	1.818	3.40
06			1.72					2.26					2	1.99	2.26
07		5.05				0.26	1.70				0.84	1.02	5	1.774	5.05
08	5.33			0.33	0.00				0.69	3.43			5	1.956	5.33
09			1.21					0.12					2	.665	1.21
10		6.45				1.63	0.64					2.13	4	2.713	6.45
11	1.94			3.35	0.53				2.05	7.48			5	3.07	7.48
12			1.69					1.33					2	1.51	1.69
13		0.07				2.67	2.21				1.22	1.17	5	1.468	2.67
14				5.93	1.14				0.07	19.49			4	6.658	19.49
15			1.12					2.62					2	1.87	2.62
16		0.72				5.34	0.84				0.60	6.34	5	2.768	6.34
17	0.97			1.08	0.63				0.37	13.14			5	3.238	13.14
18			1.74					2.69					2	2.215	2.69
19		1.43				0.43	2.92				2.21	6.15	5	2.628	6.15
20	0.27			0.45	3.11				0.05	7.32			5	2.24	7.32
21			7.59					2.65					2	5.12	7.59
22						0.56	2.46				2.20	6.26	4	2.87	6.26
23	1.12			3.22	0.49				5.02	10.90			5	3.55	10.90
24			1.54					3.11					2	2.325	3.11
25						3.60	6.05				2.29	1.50	4	3.36	6.05
26	2.73			0.90	0.30				2.98	2.69			5	1.92	2.98
27			14.25					3.81					2	9.03	14.25
28		4.83				1.08	3.09					12.78	4	5.445	12.78
29	2.05			1.54	4.63				0.90	5.82			5	2.988	5.82
30			4.52					8.48					2	6.5	8.48
31							5.50					8.22	2	6.86	8.22
NO	9	8	10	10	10	10	11	10	10	10	8	10	116		
MEAN	2.517	2.939	3.952	1.773	1.385	2.151	2.543	3.088	1.369	7.191	2.58	5.181		3.066	
MAX	5.33	6.45	14.25	5.93	4.63	5.34	6.05	8.48	5.02	19.49	7.59	12.78			19.49

FIGURE AP-1-H

AQCR: 142 AGENCY(F): STATE
CNTY: 0860 PROJECT(01): POPULATION-ORIENTED SURV.
AREA: 0720 PARM(11101): SUSPENDED PARTICULATE
SITE: 001 UNITS(01): MICROGRAMS/CUBIC METER
YEAR: 1986
LOCALE: COGSWELL BLDG #1 - LOCKEY AV & ROBERTS ST HELENA

COLLECT METH: HI-VOL
ANALYSIS METH: GRAVIMETRIC
SAMPLING INTR: DAILY
SAROAD KEY: 27/0720/001/F/01
MINIMUM DETEC: 1
LEWIS & CLARK

SLAMS/NAMS(2): SLAMS
RPT AGNCY/SMSA: / 0000
UTM ZONE: 12
UTM EASTING: 422.2570
UTM NORTHING: 5159.2990
TIME ZONE(05): MOUNTAIN

PRIMARY
FEDERAL STANDARD 260 MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR
STATE STANDARD 200 MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR

SECONDARY
150 MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR

MONTH

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	NO.	MEAN	MAX
01		35					34						2	34.5	35
02	67			135									2	101.	135
03			362										1	362.	362
04											31	188	2	109.5	188
05									22	22			2	22.	22
06								41					1	41.	41
07		307				24	26						3	119.	307
08	29			75	12								3	38.67	75
09			34										1	34.	34
10											48	42	2	45.	48
11									34	32			2	33.	34
12								24					1	24.	24
13		20				66	19						3	35.	66
14	237			113	62								3	137.3	237
15			79										1	79.	79
16											15	84	2	49.5	84
17									16	93			2	54.5	93
18								66					1	66.	66
19		80				37	31						3	49.33	80
20	18			29	56								3	34.33	56
21			154										1	154.	154
22											72	50	2	61.	72
23									35	98			2	66.5	98
24								31					1	31.	31
25		31				55	47						3	44.33	55
26	113			19	43								3	58.33	113
27			94										1	94.	94
28											118	64	2	91.	118
29									30	117			2	73.5	117
30								28					1	28.	28
31							44						1	44.	44
NO	5	5	5	5	4	4	6	5	5	5	5	5	59		
MEAN	92.8	94.6	144.6	74.2	43.25	45.5	33.5	38.	27.4	72.4	56.8	85.6		67.59	
MAX	237	307	362	135	62	66	47	66	35	117	118	188			362

FIGURE AP-2-H

STATE: MONTANA (27) AQDHS-II AIR QUALITY DATA REPORT DISPLAY N>9997 PAGE 719

AQCR: 144 AGENCY(G): COUNTY
CNTY: 1100 PROJECT(01): POPULATION-ORIENTED SURV.
AREA: 1100 PARM(11101): SUSPENDED PARTICULATE
SITE: 020 UNITS(01): MICROGRAMS/CUBIC METER
YEAR: 1986
LOCALE: ROSE PARK - 1/2 BLOCK FROM HIWAY 93 S MISSOULA

COLLECT METH: HI-VOL
ANALYSIS METH: GRAVIMETRIC
SAMPLING INTR: DAILY
SAROAD KEY: 27/1100/020/G/01
MINIMUM DETEC: 1
MISSOULA

SLAMS/NAMS(2): SLAMS
RPT AGNCY/SMSA: / 0000
UTM ZONE: 11
UTM EASTING: 728.3870
UTM NORTHING: 5193.4380
TIME ZONE(05): MOUNTAIN

PRIMARY
FEDERAL STANDARD 260 MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR
STATE STANDARD 200 MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR

SECONDARY
150 MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR

MONTH

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	NO.	MEAN	MAX
01	75	83	351	66	58	62	38	50	11		43		10	83.7	351
02	71	57	149	26	46	63	47	44	24	33	57	84	12	58.42	149
03		82	251	41	26	58	30	43	36		96	39	10	70.4	251
04	85	55	236	60	14	40	10	40	41	47	113	82	12	68.58	236
05	50	63	191	51	30	29	12	47	29	27	55	36	12	54.17	191
06	159	80		43	24	30	8	63		50	27	35	10	51.9	159
07	121	251	45	85	25	22		50	35	54	26	57	11	70.09	251
08	132	217	41	92		18	39	79	17	55	27	36	11	68.45	217
09	107	139	42	86	32	21	21	57	45	72	20	99	12	61.75	139
10	93	56	72	60		38	23	41	39	12	32	106	11	52.	106
11		140	62	61	19	52	28	55		34	43	153	10	64.7	153
12	191	65	42	23	39	58	22	33	27	42	19	150	12	59.25	191
13	264	31	74	18	165	69	19	38	10	63	56	153	12	80.	264
14	333	30	81		55	53		46	10	70	112	110	10	90.	333
15	217	56	60	42	33	31	50	61	19	76	85	48	12	65.08	217
16	154	22	48	26	41	49	25	61		88	27	58	11	54.45	154
17	34	38	51	39	45	62	26	48	22	89	56	45	12	46.	89
18	59	41	65	43	40	49	42	66		75	52	53	11	53.18	75
19		120	58	63	57	30	35	84	10	58	70	95	11	61.82	120
20	41	246	90	49	61	37	27	72	12	85	67	118	12	75.42	246
21	76	100	99	53	23	32	48	52	18	86	54	136	12	64.75	136
22	178	48	41	27	24	26	56	47	28	98		136	11	64.45	178
23	45	146	71	30	34	44	45	52	37	106	60	55	12	60.42	146
24	68	155	47	41	24	61	43	39	26	122		95	11	66.45	155
25	160	171	58	34	38	57	56	46	25	93		101	11	76.27	171
26	232	114	85	21	47	54	39	53		94	68	128	11	85.	232
27	229	373	129	17	61	60	38	52	30	47		91	11	100.6	373
28	135	342	92	25	59	81	71	60	15	54	52		11	89.64	342
29	78		56	40	53	24	48	44	30	83			9	51.78	83
30	146		57	43	73	29	39	24	18	27	82	44	11	52.91	146
31	104		65		72		47	9		52		105	7	64.86	105
NO	28	28	30	29	29	30	29	31	25	29	25	28	341		
MEAN	130.3	118.5	93.63	45.	46.21	44.63	35.59	50.19	24.56	65.24	56.08	87.43		66.57	
MAX	333	373	351	92	165	81	71	84	45	122	113	153			373

FIGURE AP-3-H

STATE: MONTANA (27) AQDHS-II AIR QUALITY DATA REPORT DISPLAY N>9997 PAGE 252

AQCR: 140 AGENCY(F): STATE
CNTY: 1720 PROJECT(05): SPECIAL STUDIES
AREA: 0080 PARM(42401): SULFUR DIOXIDE
SITE: 066 UNITS(07): PARTS PER MILLION
YEAR: 1986 MONTH(11): NOVEMBER
LOCALE: COBURN ROAD, SOUTH OF BILLINGS

COLLECT METH: INSTRUMENTAL
ANALYSIS METH: PULSED FLOURESCENT
SAMPLING INTR: 01 HOURS
SAROAD KEY: 27/0080/066/F/05
MINIMUM DETEC: .002
BILLINGS YELLOWSTONE

SLAMS/NAMS(2): SLAMS
RPT AGNCY/SMSA: / 0880
UTM ZONE: 12
UTM EASTING: 697.0000
UTM NORTHING: 5073.2890
TIME ZONE(05): MOUNTAIN

PRIMARY SECONDARY
FEDERAL STANDARD .14 PARTS PER MILLION-24 HR MAX-1 PER YEAR .5 PARTS PER MILLION-3 HR MEAN-1 PER YEAR
STATE STANDARD .5 PARTS PER MILLION-1 HR MAX-18 PER YEAR

	HOUR											
DAY	00	01	02	03	04	05	06	07	08	09	10	11
01	0.012	0.105	0.014	0.013	0.015	0.018	0.023	0.023	0.026	0.019	0.017	0.016
02	0.005	0.007	0.017	0.022	0.021	0.037	0.021	0.017	0.015	0.013	0.014	0.010
03	0.000	0.009	0.032	0.017	0.011	0.012	0.008	0.009	0.005	0.010	0.009	0.014
04	0.024	0.027	0.091	0.027	0.066	0.063	0.058	0.029	0.023	0.044	0.018	0.021
05	0.022	0.040	0.075	0.096	0.031	0.025	0.076	0.134	0.161	0.151	0.097	0.028
06	0.053	0.018	0.007	0.040	0.097	0.075	0.134	0.036	0.012	0.092	0.072	0.077
07	0.106	0.100	0.102	0.106	0.034	0.015	0.223	0.245	0.079	0.012	0.005	0.004
08	0.002	0.002	0.003	0.005	0.005	0.005	0.005	0.005	0.004	0.005	0.004	0.004
09	0.004	0.003	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0.006
10	0.004	0.004	0.020	0.027	0.126	0.088	0.081	0.068	0.046	0.016	0.057	0.022
11	0.079	0.043	0.061	0.037	0.041	0.059	0.036	0.043	0.026	0.015	0.008	0.025
12	0.011	0.004	0.005	0.004	0.004	0.006	0.008	0.011	0.009	0.018	0.058	0.198
13	0.033	0.016	0.024	0.029	0.039	0.114	0.058	0.041	0.128	0.239	0.180	0.091
14	0.005	0.010	0.019	0.037	0.145	0.113	0.272	0.164	0.076	0.048	0.100	0.025
15	0.007	0.008	0.029	0.040	0.048	0.068	0.033	0.039	0.073	0.066	0.087	0.069
16	0.041	0.012	0.028	0.034	0.086	0.054	0.025	0.038	0.028	0.037	0.027	0.025
17	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.028	0.025	0.023	0.035	0.023
18	0.003	0.004	0.004	0.010	0.018	0.019	0.018	0.010	0.024	0.031	0.161	0.111
19	0.020	0.006	0.004	0.007	0.015	0.015	0.022	0.002	0.019	0.028	0.021	0.000
20	0.003	0.002	0.006	0.034	0.145	0.097	0.066	0.043	0.040	0.047	0.027	0.009
21	0.093	0.136	0.059	0.145	0.004	0.021	0.156	0.101	0.067	0.018	0.018	0.009
22	0.002	0.022	0.013	0.015	0.016	0.018	0.020	0.046	0.023	0.043	0.027	0.043
23	0.019	0.034	0.038	0.025	0.020	0.035	0.082	0.026	0.042	0.083	0.116	0.028
24	0.012	0.036	0.018	0.033	0.062	0.035	0.023	0.054	0.041	0.016	0.035	0.013
25	0.000	0.000	0.000	0.000	0.000	0.002	0.006	0.017	0.009	0.015	0.016	0.090
26	0.030	0.087	0.060	0.038	0.060	0.095	0.060	0.117	0.067	0.036	0.027	0.039
27	0.020	0.021	0.021	0.012	0.009	0.010	0.051	0.146	0.067	0.055	0.065	0.030
28	0.003	0.005	0.005	0.216	0.238	0.161	0.060	0.202	0.164	0.086	0.114	0.051
29	0.051	0.019	0.020	0.023	0.019	0.019	0.017	0.017	0.020	0.021	0.024	0.038
30	0.008	0.010	0.008	0.006	0.006	0.009	0.031	0.050	0.017	0.034	0.054	0.067
NO	30	30	30	30	30	30	30	30	30	30	30	30
MEAN	.0224	.0263	.0262	.0367	.0461	.043	.0559	.0588	.0446	.0441	.0498	.0395
MAX	0.106	0.136	0.102	0.216	0.238	0.161	0.272	0.245	0.164	0.239	0.180	0.198

FIGURE AP-4a-H

STATE: MONTANA (27) AQDHS-II AIR QUALITY DATA REPORT DISPLAY N>9997 PAGE 253

AQCR: 140 AGENCY(F): STATE
CNTY: 1720 PROJECT(05): SPECIAL STUDIES
AREA: 0080 PARM(42401): SULFUR DIOXIDE
SITE: 066 UNITS(07): PARTS PER MILLION
YEAR: 1986 MONTH(11): NOVEMBER
LOCALE: COBURN ROAD, SOUTH OF BILLINGS

COLLECT METH: INSTRUMENTAL
ANALYSIS METH: PULSED FLOURESCENT
SAMPLING INTR: 01 HOURS
SAROAD KEY: 27/0080/066/F/05
MINIMUM DETEC: .002

BILLINGS
YELLOWSTONE

SLAMS/NAMS(2): SLAMS
RPT AGNCY/SMSA: / 0880
UTM ZONE: 12
UTM EASTING: 697.6020
UTM NORTHING: 5073.2890
TIME ZONE(05): MOUNTAIN

PRIMARY
FEDERAL STANDARD .14 PARTS PER MILLION-24 HR MAX-1 PER YEAR
STATE STANDARD .5 PARTS PER MILLION-1 HR MAX-18 PER YEAR

SECONDARY
.5 PARTS PER MILLION-3 HR MEAN-1 PER YEAR

HOUR

DAY	12	13	14	15	16	17	18	19	20	21	22	23	NO.	MEAN	MAX
01	0.012	0.014	0.009	0.005	0.005	0.007	0.011	0.002	0.032	0.032	0.009	0.007	24	.0185	0.105
02	0.009	0.009	0.011	0.000	0.000	0.000	0.000	0.008	0.017	0.022	0.013	0.001	24	.012	0.037
03	0.043	0.038	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.031	0.058	0.100	24	.017	0.100
04	0.023	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.021	0.003	0.021	24	.0237	0.091
05	0.068	0.074	0.019	0.011	0.003	0.002	0.004	0.005	0.001	0.001	0.002	0.011	24	.0473	0.161
06	0.064		0.016	0.006	0.021	0.045	0.009	0.011	0.032	0.117	0.101	0.100	23	.0536	0.134
07	0.014	0.019	0.008	0.002	0.003	0.092	0.010	0.004	0.002	0.002	0.002	0.002	24	.0496	0.245
08	0.004	0.003	0.004	0.003	0.004	0.005	0.005	0.004	0.004	0.004	0.004	0.003	24	.004	0.005
09	0.014	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.004	0.003	24	.0041	0.014
10	0.018	0.013	0.012	0.012	0.047	0.005	0.017	0.005	0.009	0.006	0.040	0.048	24	.0329	0.126
11	0.016	0.029	0.002	0.016	0.003	0.003	0.004	0.005	0.004	0.003	0.003	0.003	24	.0235	0.079
12	0.103			0.070	0.075	0.053	0.054	0.058	0.049	0.112	0.048	0.320	22	.058	0.320
13	0.023	0.029	0.024	0.043	0.058	0.068	0.061	0.156	0.180	0.337	0.050	0.031	24	.0855	0.337
14	0.013	0.010	0.004	0.003	0.008	0.006	0.055	0.006	0.034	0.069	0.007	0.007	24	.0515	0.272
15	0.072	0.016	0.027	0.009	0.017	0.035	0.051	0.032	0.020	0.056	0.028	0.066	24	.0415	0.087
16	0.028	0.034	0.025	0.012	0.001	0.006	0.004	0.003	0.003	0.004	0.018	0.008	24	.0242	0.086
17	0.013	0.007	0.000	0.000	0.000	0.000	0.000	0.013	0.020	0.000	0.001	0.002	24	.008	0.035
18	0.132	0.231	0.138	0.024	0.011	0.010	0.035	0.026	0.019	0.135	0.084	0.030	24	.0536	0.231
19	0.000			0.000	0.000	0.000	0.000	0.000	0.003	0.009	0.029	0.004	22	.0092	0.029
20	0.017	0.023	0.019	0.019	0.000	0.000	0.010	0.019	0.026	0.052	0.032	0.015	24	.0312	0.145
21	0.017	0.039	0.013	0.008	0.003	0.018	0.028	0.017	0.021	0.015	0.016	0.028	24	.0433	0.156
22	0.065	0.042	0.030	0.004	0.005	0.019	0.015	0.014	0.027	0.018	0.016	0.027	24	.0237	0.065
23	0.012	0.084	0.009	0.019	0.021	0.015	0.009	0.030	0.017	0.028	0.025	0.017	24	.0347	0.116
24	0.001	0.007	0.041	0.022	0.002	0.014	0.002	0.008	0.049	0.169	0.023	0.013	24	.0303	0.169
25	0.014	0.013	0.030	0.016	0.002	0.020	0.014	0.033	0.087	0.085	0.039	0.063	24	.0237	0.090
26	0.050	0.053	0.024	0.027	0.048	0.008	0.008	0.022	0.063	0.004	0.012	0.007	24	.0409	0.117
27	0.041	0.059	0.019	0.011	0.022	0.004	0.007	0.003	0.115	0.030	0.015	0.006	24	.0349	0.146
28	0.017	0.118	0.073	0.009	0.015	0.021	0.014	0.092	0.186	0.023	0.087	0.144	24	.0876	0.238
29	0.032	0.012	0.008	0.007	0.010	0.007	0.020	0.011	0.008	0.033	0.021	0.012	24	.0195	0.051
30	0.012	0.005	0.003	0.004	0.005	0.005	0.004	0.005	0.016	0.051	0.062	0.038	24	.0212	0.067
NO	30	27	28	30	30	30	30	30	30	30	30	30	715		
MEAN	.0315	.0361	.0205	.0121	.013	.0157	.0151	.0128	.0332	.0491	.0284	.0379		.0336	
MAX	0.132	0.231	0.138	0.070	0.075	0.092	0.061	0.156	0.186	0.337	0.101	0.320			0.337

FIGURE AP-4b-H

AQCR: 141 AGENCY(03): COUNTY
CNTY: 0220 POLL CT(02): SOURCE-ORIENTED AMBIENT SURV.
AREA: 0000 PARM(42101): CARBON MONOXIDE
SITE: 0?? UNITS(07): PARTS PER MILLION
YEAR: 1986 MONTH(10): OCTOBER
LOCALE: PARDIS CLINIC - 826 10TH AVE SOUTH GREAT FALLS CASCADE

COLLECT METH: INSTRUMENTAL
ANALYSIS METH: NONDISPERSIVE INFRA-RED
SAMPLING INTR: 01 HOURS
SAROAD KEY: 27/0660/023/G/02
MINIMUM DETEC: .5

SLAMS/NAMS(2): SLAMS
RPT AGNCY/SMSA: / 3040
UTM ZONE: 12
UTM EASTING: 478.0000
UTM NORTHING: 5259.8800
TIME ZONE(05): MOUNTAIN

PRIMARY SECONDARY
FEDERAL STANDARD 35 PARTS PER MILLION-1 HR MAX-1 PER YEAR 9 PARTS PER MILLION-8 HR MAX-1 PER YEAR
STATE STANDARD 23 PARTS PER MILLION-1 HR MAX-1 PER YEAR

	HOUR											
DAY	00	01	02	03	04	05	06	07	08	09	10	11
01	0.5	0.4	0.3	0.3	0.4	0.7	1.5	1.6	1.6		2.4	3.5
02	0.5	0.2	0.0	0.0	0.1	0.4	1.0	1.1	1.3	1.6	2.5	2.8
03	0.4	0.4	0.4	0.3	0.7	0.3	0.5	1.2	0.7	0.3	0.4	1.6
04	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.5	0.8
05	0.5	0.5	0.4	0.4	0.4	0.6	0.6	0.4	0.3	0.3	0.4	0.4
06	0.4	0.4	0.3	0.3	0.3	0.3	0.5	0.4	0.4	0.5	0.5	1.1
07	1.1	1.1	0.7	0.4	0.8	1.9	5.9	9.6	1.3	0.9	0.6	0.8
08	0.3	0.2	0.1	0.1	0.2	0.7	3.0	3.5	3.3	3.4	3.6	4.6
09	0.3	0.2	0.1	0.1	0.1	0.2	0.6	0.3	0.3	0.2	0.2	1.0
10	0.3	0.2	0.2	0.3	0.4	0.9	2.0	2.2	2.0	2.1	2.2	2.1
11	1.8	1.4	0.9	1.5	1.0	1.1	1.3	2.1	1.3	0.9	1.1	1.6
12	3.7	4.1	3.7	3.4	3.1	2.1	2.5	4.4	3.2	1.2	1.0	0.7
13	0.5	0.4	0.3	0.4	0.6	1.8	3.9	3.7	3.0	2.5	1.6	1.9
14	1.5	1.1	0.8	0.8	1.2	2.0	2.9	3.1	3.2	2.2	2.3	2.4
15	1.8	1.8	1.9	1.8	2.2	3.0	6.7	3.7	1.2	0.8	0.6	0.8
16	3.2	2.0	1.8	1.5	1.8	2.7	8.7	13.3	10.8	6.8	3.3	1.1
17	3.6	4.2	1.4	1.6	2.7	4.6	4.9	3.2	4.7		2.5	3.5
18	1.7	2.1	1.3	1.0	1.3	1.1	1.3	1.9	2.2	3.0	1.9	2.5
19	1.9	1.8	1.4	1.1	0.9	0.9	1.1	2.0	1.4	1.3	1.4	1.4
20	1.1	1.1	0.7	0.6	0.7	0.8	3.0	3.1	2.6	2.1	2.7	2.7
21	2.0	1.4	1.1	0.9	1.1	1.8	5.0	7.2	4.5	2.8	2.6	2.7
22	1.8	1.5	0.9	0.9	1.5	2.9	4.6	4.0	2.6	2.3	2.3	2.8
23	2.0	1.3	1.1	0.9	0.9	1.2	2.1	2.8	2.6		3.8	2.9
24	2.6	2.8	1.8	1.2	1.1	2.3	8.4	10.6	13.1	5.1	1.9	1.3
25	2.3	2.0	1.1	0.9	1.1	1.1	2.5	4.2	5.6	1.7	0.6	0.6
26	5.5	5.3	1.8	1.6	1.2	0.8	0.6	0.6	0.4	0.3	0.3	0.4
27	0.5	0.2	0.2	0.2	0.1	0.2	0.2	1.0	0.4	0.3	0.4	0.4
28	0.3	0.3	0.3	0.3	0.3	0.3	0.5	0.5	0.4	0.3	0.3	0.4
29	1.5	1.2	1.0	1.2	0.9	1.0	1.7	2.6	3.4	2.2	1.6	1.5
30	1.3	1.1	1.0	0.8	0.6	0.3	0.2	0.3	0.3	0.2	0.2	0.4
31	0.3	0.2	0.2	0.3	0.4	0.5	0.7	2.0	2.8	3.3	3.8	4.8
NO	31	31	31	31	31	31	31	31	31	28	31	31
MEAN	1.471	1.329	.887	.8193	.9161	1.252	2.539	3.113	2.619	1.746	1.594	1.79
MAX	5.5	5.3	3.7	3.4	3.1	4.6	8.7	13.3	13.1	6.8	3.8	4.8

FIGURE AP-5a-H

STATE: MONTANA (27) AQDHS-II AIR QUALITY DATA REPORT DISPLAY N>9997 PAGE 411

AQCR: 141 AGENCY(G): COUNTY COLLECT METH: INSTRUMENTAL SLAMS/NAMS(2): SLAMS
CNTY: 0220 PROJECT(S2): SOURCE-ORIENTED AMBIENT SURV. ANALYSIS METH: NONDISPERSIVE INFRA-RED RPT AGNCY/SMSA: / 3040
AREA: 0660 PARM(421(1): CARBON MONOXIDE SAMPLING INTR: 01 HOURS UTM ZONE: 12
SITE: 027 UNITS(17): PARTS PER MILLION SAROAD KEY: 27/0660/023/G/02 UTM EASTING: 478.0000
YEAR: 1986 MONTH(1(): OCTOBER MINIMUM DETEC: .5 UTM NORTHING: 5259.8800
LOCALE: PARDIS CLINIC - 826 10TH AVE SOUTH GREAT FALLS CASCADE TIME ZONE(C5): MOUNTAIN

PRIMARY SECONDARY
FEDERAL STANDARD 35 PARTS PER MILLION-1 HR MAX-1 PER YEAR 9 PARTS PER MILLION-8 HR MAX-1 PER YEAR
STATE STANDARD 23 PARTS PER MILLION-1 HR MAX-1 PER YEAR

HOUR

DAY	12	13	14	15	16	17	18	19	20	21	22	23	NO.	MEAN	MAX
01	3.1	3.1	3.0	3.9	2.5	1.9	1.4	2.4	2.5	2.0	1.3	0.9	23	1.791	3.9
02	2.7	2.4	3.3	3.0	3.5	2.6	2.1	1.8	1.8	1.2	1.1	0.7	24	1.571	3.5
03	1.5	0.7	0.6	0.8	0.8	0.8	0.6	0.5	0.5	0.5	0.5	0.5	24	.6458	1.6
04	0.9	2.1	1.7	2.2	1.8	2.5	1.8	2.1	1.5	1.4	0.8	0.6	24	.9958	2.5
05	0.6	0.5	0.5	0.4	0.5	0.5	0.5	0.5	1.1	1.7	0.6	0.5	24	.5458	1.7
06	0.6	0.5		0.2	0.6	0.3	0.6	0.4	2.8	1.4	2.0	1.8	23	.7217	2.8
07	0.5	0.3	0.3	0.3	0.6	0.4	1.2	0.9	1.0	1.4	1.4	0.5	24	1.413	9.6
08	4.5	3.6	3.8	3.1	3.5	3.6	3.6	2.3	1.7	1.5	1.1	0.7	24	2.321	4.6
09	0.6	0.4	0.9	1.4	2.0	2.8	2.3	2.1	1.4	0.4	0.4	0.4	24	.7791	2.8
10	2.1	1.8	2.4	2.9	2.6	2.9	2.7	2.8	3.6	3.3	2.3	1.9	24	1.925	3.6
11	1.1	2.0	1.8	1.3	0.8	1.2	1.4	1.2	1.5	1.1	2.5	2.2	24	1.421	2.5
12	0.7	0.7	1.3	0.8	1.4	0.8	1.0	0.7	0.5	0.4	0.4	0.7	24	1.771	4.4
13	1.2	1.1	0.8	1.0	0.8	0.9	3.3	6.0	3.8	2.2	3.0	1.6	24	1.929	6.0
14	1.4	1.3	1.0	1.0	0.7	1.8	3.1	1.7	2.1	4.2	2.2	2.6	24	1.942	4.2
15	1.3	1.0	0.7	1.4	1.0	3.4	6.4	6.0	7.0	9.0	6.9	2.8	24	3.05	9.0
16	0.8	0.6	0.6	0.6	1.2	1.3	1.2	0.7	0.9	7.6	7.6	2.6	24	3.442	13.3
17	1.4	1.9	1.9	2.6	4.6	12.3	12.3	10.8	11.6	5.5	4.0	2.8	23	4.722	12.3
18	2.3	2.8	3.1	3.3	4.8	7.2	8.6	11.4	10.1	7.7	3.4	2.1	24	3.671	11.4
19	1.3	1.3	2.1	3.0	2.9	4.1	3.2	5.6	5.3	3.5	2.7	1.4	24	2.333	8.6
20	1.9	0.8	1.0	1.9	2.2	10.9	11.8	5.3	4.9	5.6	5.6	2.5	24	3.171	11.8
21	2.1	1.9	2.8	3.7	5.9	6.7	5.1	3.5	2.5	4.1	5.5	3.3	24	3.342	7.2
22	2.4	3.1	2.9	4.2	5.5	5.2	7.5	7.2	7.7	2.2	2.0	2.0	24	3.333	7.7
23	3.1	3.2	3.2	3.6	4.7	5.9	6.5	9.5	7.4	6.8	3.8	2.1	23	3.539	9.5
24	1.0	0.6	0.4	0.5	0.7	1.0	1.4	2.1	3.4	3.5	2.3	3.3	24	3.013	13.1
25	1.1	0.5	0.5	0.5	0.4	0.6	0.5	1.4	2.9	3.8	4.5	4.2	24	1.858	5.6
26	0.3	0.4	0.4	1.2	0.6	0.5	0.4	0.6	0.3	0.3	0.3	0.2	24	1.013	5.5
27	0.6	0.4	0.4	0.4	0.6	0.7	0.5	0.4	0.4	0.4	0.4	0.3	24	.4	1.0
28	0.7	0.7	0.6	0.8	1.3	1.3	2.6	1.7	1.8	2.2	1.2	2.3	24	.8916	2.6
29	2.5	3.1	3.3	3.5	5.6	6.8	5.7	4.6	2.9	3.7	3.6	2.3	24	2.808	6.8
30	0.5		1.1	1.8	2.5	2.3	2.5	2.8	2.0	1.1	0.8	0.6	23	1.074	2.8
31	4.5	3.8	1.3	1.4	1.3	1.5	1.9	2.3	3.5	3.9	2.0	2.4	24	2.033	4.8
NO	31	30	30	31	31	31	31	31	31	31	31	31	739		
MEAN	1.59	1.557	1.59	1.829	2.19	3.055	3.345	3.371	3.239	3.019	2.458	1.703		2.045	
MAX	4.5	3.8	3.8	4.2	5.9	12.3	12.3	11.4	11.6	9.0	7.6	4.2			13.3

177

FIGURE AP-5b-H

SITE CODE: 27-[illegible]-714-F-02 AGENCY TYPE: STATE COUNTY: Jefferson
AGENCY/PROJECT: F 2 SITE ADDRESS: FIREHALL - 2 EAST PACIFIC ST CITY: EAST HELENA

POLLUTANT NAME / POLLUTANT-METHOD-INTERVAL-UNITS CODE / Yr/Mon	PCT OBS	NBR OBS	MIN DATE	MIN VAL	PERCENTILES 10		50		90	95	99	MAX OBS	2ND MAX	3RD MAX	ARIT MEAN	ARIT ST DEV	GEOM MEAN	GEOM ST DEV	TIMES HALF M DET SUB
SUSPENDED PARTICULATE					HI-VOL				- GRAVIMETRIC					DAILY		MICROGRAMS/CUBIC METER			
11101-01-0-0 1																			
86/01	29.0	9	1.000	38.00	38.	61.	78.	98.	130.	130.	130.	130.0	116.0	98.00	79.44	31.00	73.87	1.512	0
86/02	28.6	8	1.000	24.00	24.	58.	83.	100.	118.	118.	118.	116.0	116.0	100.0	78.50	34.50	69.90	1.752	0
86/03	29.0	9	1.000	34.00	34.	46.	94.	109.	161.	161.	161.	161.0	133.0	109.0	87.11	44.28	76.11	1.780	0
86/04	33.3	10	1.000	19.00	32.	44.	60.	68.	99.	118.	118.	118.0	99.00	90.00	62.70	31.75	54.97	1.761	0
86/05	32.3	10	1.000	7.000	26.	45.	48.	57.	91.	93.	93.	93.00	91.00	75.00	52.90	27.28	43.90	2.126	0
86/06	33.3	10	1.000	34.00	40.	54.	57.	67.	75.	82.	82.	82.00	75.00	72.00	59.70	14.68	57.94	1.302	0
86/07	35.5	11	1.000	20.00	36.	45.	48.	65.	81.	92.	92.	92.00	81.00	76.00	55.09	21.78	50.84	1.550	0
86/08	32.3	10	1.000	49.00	50.	70.	71.	80.	80.	86.	86.	86.00	80.00	80.00	71.60	12.03	70.61	1.197	0
86/09	33.3	10	1.000	5.000	9.	24.	27.	34.	75.	80.	80.	80.00	75.00	56.00	36.60	25.42	28.57	2.191	0
86/10	32.3	10	1.000	16.00	30.	64.	80.	102.	178.	209.	209.	209.0	178.0	173.0	108.3	69.54	82.72	2.369	0
86/11	26.7	8	1.000	26.00	26.	49.	64.	72.	94.	94.	94.	94.00	82.00	72.00	61.37	22.28	57.27	1.520	0
86/12	32.	10	1.000	30.00	60.	86.	100.	129.	169.	171.	171.	171.0	169.0	141.0	106.8	46.66	95.60	1.711	0
COPPER					HI-VOL				- EMISSION SPECTRA ICAP					DAILY		MICROGRAMS/CUBIC METER			
12114-[illegible]-0-0 1																			
86/01	29.0	9	0.003	1.840	1.84	2.82	4.02	14.32	54.37	54.37	54.37	54.37	33.08	14.32	13.75	16.24	6.676	3.470	0
86/02	28.6	8	0.003	0.390	0.39	4.65	6.82	16.93	21.84	21.84	21.84	21.84	21.44	16.93	10.24	8.524	6.136	3.789	0
86/03	32.3	10	0.003	0.520	2.12	3.40	6.80	14.41	21.39	31.06	31.06	31.06	21.39	19.91	11.15	10.19	6.463	3.568	0
86/04	33.3	10	0.003	0.360	0.72	1.03	1.66	2.14	2.99	11.29	11.29	11.29	2.990	2.520	2.560	3.182	1.638	2.568	0
86/05	32.3	10	0.003	0.550	0.64	1.36	1.85	4.22	9.81	11.04	11.04	11.04	9.810	6.100	3.896	3.907	1.786	5.701	0
86/06	33.3	10	0.003	0.620	1.11	1.86	2.65	5.41	10.62	16.41	16.41	16.41	10.62	9.110	5.294	5.175	3.347	2.843	0
86/07	35.5	11	0.003	1.150	1.20	2.82	5.83	7.67	11.33	16.27	16.27	16.27	11.33	9.280	6.492	4.634	4.837	2.411	0
86/08	32.3	10	0.003	0.490	1.06	2.75	3.84	8.41	14.16	15.76	15.76	15.76	14.16	8.450	6.677	5.296	4.278	3.195	0
86/09	33.3	10	0.003	0.150	0.27	1.09	1.16	6.00	13.51	30.12	30.12	30.12	13.51	11.86	6.764	9.557	2.119	6.054	0
86/10	32.3	10	0.003	0.220	0.77	4.67	6.81	9.67	37.09	70.72	70.72	70.72	37.09	28.64	16.77	22.62	5.770	6.133	0
86/11	26.7	8	0.003	0.570	0.37	3.00	3.08	4.31	7.70	7.70	7.70	7.700	4.530	4.310	3.461	2.217	2.627	2.552	0
86/12	32.3	10	0.003	0.670	0.70	5.65	6.44	6.91	20.35	28.23	28.23	28.23	20.35	11.30	9.010	8.853	5.238	3.493	0
LEAD					HI-VOL				- EMISSION SPECTRA ICAP					DAILY		MICROGRAMS/CUBIC METER			
12128-[illegible]-0-0 1																			
86/01	29.0	9	0.010	1.270	0.27	1.12	2.05	3.27	5.33	5.35	5.33	5.330	4.970	3.270	2.516	1.749	1.867	2.540	0
86/02	28.6	8	0.010	0.870	0.87	1.43	1.88	4.85	6.45	6.45	6.45	6.450	5.050	4.830	2.938	2.297	1.687	4.398	0
86/03	32.3	10	0.010	1.120	1.21	1.69	1.72	4.14	7.59	14.25	14.25	14.25	7.590	4.520	3.952	4.163	2.710	2.359	0
86/04	33.3	10	0.010	0.220	0.33	0.55	0.90	1.54	3.40	5.43	5.93	5.930	3.400	3.350	1.775	1.869	1.061	2.992	0
86/05	32.3	10	0.010	0.220	0.33	0.49	0.53	1.14	3.11	4.63	4.63	4.630	3.110	2.580	1.385	1.530	0.533	6.780	1
86/06	33.3	10	0.010	0.300	0.43	1.10	1.63	2.67	3.60	5.34	5.34	5.340	3.600	3.520	2.151	1.655	1.473	2.776	0
86/07	35.	11	0.010	0.440	0.64	1.71	2.32	2.42	5.50	6.05	6.05	6.050	5.500	3.090	2.542	1.849	1.842	2.603	0
86/08	32.3	10	0.010	0.140	1.33	2.56	2.65	3.11	3.61	8.48	8.48	8.480	3.310	3.810	3.086	2.192	2.193	3.076	0
86/09	33.3	10	0.010	0.050	0.07	0.45	0.69	1.13	2.98	5.62	5.62	5.620	2.960	2.050	1.369	1.578	0.642	4.484	0
86/10	32.3	10	0.010	0.090	1.55	3.43	5.82	7.48	13.14	19.49	19.49	19.49	13.14	10.90	7.191	5.953	4.035	4.657	0
86/11	26.7	8	0.010	0.800	0.80	1.26	2.25	2.27	7.59	7.59	7.59	7.590	3.690	2.290	2.580	2.251	1.929	2.254	0
86/12	32.3	10	0.010	1.020	1.17	2.15	6.15	6.25	9.22	12.78	12.78	12.78	8.220	6.340	5.181	3.768	3.789	2.472	0

FIGURE AP-6-H

SITE CODE: 27-009-0005-1-11 AGENCY TYPE: STATE COUNTY: 1720
AGENCY/PROJECT: PSI SITE NAME: LOCKWOOD PARK (NAME SITE) CITY: BILLINGS

POLLUTANT NAME / POLLUTANT-METHOD-INTERVAL-UNITS CODE / YR/MON	PCT OBS	NUM OBS	MIN LEVEL	MIN OBS	PERCENTILES 10	30	50	70	90	95	99	MAX OBS	2ND MAX	METHOD OF COLLECTION AND ANALYSIS / INTERVAL / 3RD MAX	UNITS / ARIT MEAN	ARIT ST DEV	GEOM MEAN	GEOM ST DEV	TIMES HALF M DET SUB
SUSPENDED PARTICULATE														- GRAVIMETRIC / DAILY	MICROGRAMS/CUBIC METER				
11101-01-11-21																			
86/01	16.1	5	1.000	32.00	32.	38.	50.	61.	73.	73.	73.	73.00	61.00	60.00	52.80	17.16	50.39	1.419	0
86/02	10.7	3	1.000	16.00	16.	16.	20.	41.	41.	41.	41.	41.00	20.00	16.00	25.66	13.42	23.58	1.635	0
86/03	16.1	5	1.000	29.00	29.	32.	70.	76.	136.	136.	136.	136.0	76.00	70.00	68.60	43.32	58.26	1.907	0
86/04	16.7	5	1.000	20.00	20.	34.	55.	58.	97.	97.	97.	97.00	58.00	55.00	53.80	28.49	47.48	1.790	0
86/05	16.1	5	1.000	18.00	18.	63.	64.	110.	151.	151.	151.	151.0	110.0	64.00	81.20	50.80	65.49	2.252	0
86/06	16.7	5	1.000	53.00	53.	75.	77.	117.	122.	122.	122.	122.0	117.0	77.00	88.80	29.61	84.73	1.414	0
86/07	19.4	6	1.000	44.00	44.	54.	64.	82.	122.	122.	122.	122.0	82.00	78.00	75.66	26.33	72.11	1.402	0
86/08	12.9	4	1.000	52.00	52.	57.	57.	92.	178.	178.	178.	178.0	92.00	67.00	97.25	56.30	86.91	1.702	0
86/09	16.7	5	1.000	31.00	31.	36.	53.	56.	82.	82.	82.	82.00	56.00	53.00	51.60	20.08	48.61	1.469	0
86/10	16.1	5	1.000	27.00	27.	40.	120.	151.	225.	225.	225.	225.0	151.0	120.0	113.8	80.49	87.27	2.406	0
86/11	16.7	5	1.000	25.00	25.	37.	43.	61.	77.	77.	77.	77.00	61.00	43.00	48.80	20.22	45.46	1.529	0
86/12	9.7	3	1.000	71.00	71.	71.	83.	118.	118.	118.	118.	118.0	83.00	71.00	90.66	24.42	88.59	1.297	0
SULFUR DIOXIDE														INSTRUMENTAL - PULSED FLUORESCENT / HOURLY	PARTS PER MILLION				
42401-20-1-17																			
86/01	94.5	746	.002	0.000	0.000	0.000	0.000	0.010	0.034	0.058	0.078	0.191	0.329	0.279	0.027	0.034	0.016	2.973	25
86/02	99.4	699	0.002	0.000	0.000	0.000	0.002	0.007	0.022	0.050	0.083	0.170	0.441	0.243	0.264	0.021	0.036	0.007	4.765	164
86/03	98.7	734	0.002	0.000	0.000	0.000	0.004	0.010	0.057	0.104	0.170	0.302	0.269	0.256	0.019	0.037	0.005	4.780	212
86/04	98.7	711	0.002	0.000	0.000	0.000	0.004	0.010	0.013	0.065	0.115	0.209	0.275	0.270	0.240	0.025	0.040	0.013	2.945	17
86/05	96.5	716	0.002	0.000	0.000	0.000	0.000	0.002	0.006	0.011	0.047	0.088	0.195	0.244	0.228	0.224	0.017	0.033	0.005	4.288	198
86/06	98.9	715	0.002	0.000	0.000	0.000	0.000	0.004	0.017	0.067	0.105	0.234	0.437	0.400	0.377	0.023	0.047	0.005	5.717	306
86/07	99.1	737	0.002	0.000	0.000	0.000	0.000	0.008	0.025	0.083	0.121	0.212	0.373	0.255	0.252	0.027	0.045	0.007	5.866	259
86/08	85.8	638	0.002	0.000	0.000	0.000	0.004	0.012	0.020	0.087	0.123	0.206	0.304	0.241	0.234	0.030	0.044	0.011	4.504	67
86/09	97.9	705	0.002	0.000	0.000	0.000	0.002	0.003	0.010	0.034	0.090	0.163	0.325	0.208	0.197	0.017	0.033	0.004	4.567	199
86/10	99.3	739	0.002	0.000	0.002	0.000	0.000	0.007	0.017	0.064	0.085	0.168	0.282	0.432	0.368	0.369	0.034	0.043	0.019	2.869	0
86/11	99.0	713	0.002	0.000	0.000	0.001	0.004	0.012	0.025	0.051	0.079	0.139	0.341	0.262	0.247	0.022	0.031	0.009	4.160	122
86/12	98.9	733	0.002	0.000	0.000	0.002	0.012	0.025	0.044	0.073	0.094	0.130	0.361	0.245	0.184	0.033	0.032	0.018	3.706	45
WIND SPEED														INSTRUMENTAL - GAS/MANUAL AVERAGE / HOURLY	METERS PER SECOND				
61101-99-1-11																			
86/01	100.0	744	0.300	0.300	1.0	1.7	2.4	3.7	5.6	6.8	9.2	11.70	10.90	9.900	2.950	1.973	2.342	2.040	0
86/02	85.1	573	0.300	0.300	0.8	1.3	2.1	2.8	4.6	5.7	8.4	9.600	9.300	8.900	2.351	1.653	1.783	2.291	22
86/03	99.9	743	0.300	0.100	0.7	1.3	2.2	3.2	5.7	6.9	9.0	10.20	9.800	9.700	2.705	2.014	2.026	2.237	6
86/04	100.0	720	0.300	0.100	0.9	1.6	2.5	3.4	5.8	7.1	8.3	10.20	10.20	9.700	2.970	1.983	2.294	2.174	5
86/05	100.0	744	0.300	0.100	0.8	1.6	2.5	3.1	6.6	8.1	10.6	13.40	12.10	11.80	3.208	2.383	2.403	2.256	7
86/06	100.0	72	0.300	0.300	1.0	1.6	2.1	3.1	4.6	5.4	6.5	9.300	9.200	8.000	2.532	1.494	2.125	1.639	0
86/07	99.6	741	0.300	0.100	0.9	1.6	2.1	3.2	4.7	5.6	8.4	11.30	10.50	10.10	2.509	1.667	2.037	1.942	0
86/08	89.5	666	0.300	0.100	0.7	1.3	1.9	2.6	4.0	4.7	6.1	10.00	7.800	7.200	2.182	1.356	1.778	1.962	2
86/09	99.6	717	0.300	0.300	0.7	1.4	2.0	2.7	4.1	5.2	9.0	11.10	10.70	10.50	2.310	1.644	1.835	2.032	4
86/10	98.1	730	0.300	0.100	0.9	1.7	2.5	3.6	5.5	6.5	8.700	8.700	8.500	1.783	1.268	1.364	2.174	13
86/11	61.2	441	0.300	0.100	0.8	1.4	1.7	2.7	4.4	5.4	6.9	7.900	7.600	7.200	2.173	1.506	1.693	2.104	4
86/12	96.8	720	0.300	0.100	0.8	1.7	2.3	3.2	5.1	6.4	8.1	9.100	9.100	9.000	2.690	1.766	2.104	2.181	15

FIGURE AP-7-H

AQDHS-II STATISTICAL ANALYSIS REPORT
ANALYSIS BY YEAR
STATE (27): MONTANA

SITE CODE: 27-0080-065-F-01 AGENCY TYPE: STATE COUNTY: 1720
AGENCY/PROJECT: 1*1 SITE ADDRESS: LOCKWOOD PARK (MAMS SITE) CITY: BILLINGS

POLLUTANT NAME / POLL-METH-INTRV-UNITS COD / YEAR	PCT OBS	NBR OBS	MIN VALUE	MIN OBS	METHOD OF COLLECTION AND ANALYSIS / PERCENTILES 10	30	50	70	90	95	99	MAX OBS	2ND MAX	INTERVAL 3RD MAX	UNITS ARIT MEAN	ARIT ST DEV	GEOM MEAN	GEOM ST DEV	TIMES HALF M DET SUB
SUSPENDED PARTICULATE					HI-VOL				- GRAVIMETRIC					DAILY	MICROGRAMS/CUBIC METER				
11101-91-0-01																			
86	15.3	56	1.000	10.30	27.	44.	63.	78.	122.	151.	225.	225.0	179.0	151.0	71.23	42.30	60.39	1.807	0
SULFUR DIOXIDE					INSTRUMENTAL				- PULSED FLOURESCENT					HOURLY	PARTS PER MILLION				
42401-20-1-07																			
86	37.5	3340	0.001	0.000	0.000	0.004	0.010	0.025	0.060	0.100	0.197	0.441	0.437	0.432	0.025	0.039	0.009	4.561	1,614
WIND SPEED					INSTRUMENTAL				- DAS/MANUAL AVERAGE					HOURLY	METERS PER SECOND				
61101-50-1-11																			
86	94.3	8259	0.300	0.000	.7	1.4	2.1	3.1	5.0	6.1	8.8	12.40	12.10	11.80	2.549	1.808	1.974	2.135	78
WIND DIRECTION					INSTRUMENTAL				- DAS/MANUAL AVERAGE					HOURLY	DEGREES				
61102-50-1-14																			
86	73.0	6394	1.000	0.000	40.	140.	202.	235.	287.	310.	351.	360.0	360.0	360.0	182.1	88.80	143.5	2.391	9
STD DEV OF HORIZON WIND DIR					INSTRUMENTAL				- ELECTRONIC AVERAGE					HOURLY	DEGREES				
61106-50-1-14																			
86	69.3	6067	1.000	0.000	7.	14.	21.	35.	58.	67.	80.	88.00	88.00	88.00	27.67	19.26	21.70	2.036	1
TEMPERATURE					INSTRUMENTAL				- ELECTRONIC AVERAGE					HOURLY	DEGREES CENTIGRADE				
62101-40-1-17																			
86	94.3	8256	-999.	-25.0	-2.9	3.9	8.6	14.3	22.7	26.1	30.5	36.20	36.00	35.90	9.229	10.18	N/A	N/A	0

FIGURE AP-8-H

SITE CODE: 27-033-0010-P-05 AGENCY TYPE: STATE COUNTY: 033
AGENCY/PROJECT: PDS SITE ADDRESS: MARLENES RANCH, NORTH OF SCOBEY CITY: SCOBEY

POLLUTANT NAME / POLL-METH-INTRV-UNITS CODE / YEAR	METHOD OF COLLECTION AND ANALYSIS	PCT OBS	NUM DAYS	MIN DETEC	MIN OBS	PERCENTILES 10	20	50	70	90	95	99	MAX OBS	2ND MAX	3RD MAX	INTERVAL	UNITS	ARIT MEAN	ARIT ST DEV	GEOM MEAN	GEOM ST DEV	TIMES HALF M DET SUB
SUSPENDED PARTICULATE 11101-91-1-51	HI-VOL									- GRAVIMETRIC						DAILY	MICROGRAMS/CUBIC METER					
86	4.1	15	1.000	0.000	7.	9.	14.	32.	45.	140.	140.	140.0	45.00	44.00		28.93	33.93	18.70	2.513	0
SULFUR DIOXIDE 42401-20-1-07	INSTRUMENTAL									- PULSED FLOURESCENT						HOURLY	PARTS PER MILLION					
86	26.1	2462	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.010	0.075	0.045	0.035		0.001	0.002	0.001	1.524	2,343
WIND SPEED 61101-40-1-11	INSTRUMENTAL									- VISUAL AVERAGE						HOURLY	METERS PER SECOND					
86	8.4	733	0.300	0.000	0.4	0.9	1.3	2.7	5.8	8.0	11.2	14.70	14.70	12.10		2.398	2.482	1.416	3.010	56
WIND DIRECTION 61102-40-1-14	INSTRUMENTAL									- VISUAL AVERAGE						HOURLY	DEGREES					
86	8.4	737	1.000	0.000	126.	150.	216.	252.	324.	342.	360.	370.0	360.0	360.0		220.8	72.88	202.7	1.638	0
TEMPERATURE 62101-50-1-15	INSTRUMENTAL									- VISUAL CHART AVERAGE						HOURLY	DEGREES FAHRENHEIT					
86	8.4	733	-999.	-5.00	9.0	20.0	26.0	29.0	34.0	35.0	41.0	43.00	43.00	43.00		23.62	9.960	N/A	N/A	0

FIGURE AP-9-H

AQDHS-II STANDARDS REPORT FROM JAN 1986 TO DEC 1986
P A R T I C U L A T E
DAILY VALUES

REPORT DATE: MAY 6, 1987

STATE (27): MONTANA

SITE CODE: 27-090 -01
AGENCY (F): STATE
PROJECT (01): POPULATION-ORIENTED SURV.
CITY POPULATION:
AQCR POPULATION:
EPA REGION: 8
SUPPORTING AGENCY: MONTANA AIR QUALITY BUREAU

LOCATION: LIBBY
COUNTY (0940): LINCOLN
SITE ADDR: LINCOLN CO COURTHOUSE, 418 MINERAL AVE
STATION TYPE (13): CENTER CITY: COMMERICAL
AQCR: 144 SMSA: 0000
SLAMS/NAMS ID (2): SLAMS

LATITUDE: D. M. S.
LONGITUDE: D. M. S.
UTM ZONE: 13
UTM NORTHING: 5360.4290 M.
UTM EASTING: 607.1330 M.
ELEVATION ABOVE GROUND: 12.0 M.
ELEVATION ABOVE MSL: 2,000 FT.
TIME ZONE: MOUNTAIN

COLLECTION METHOD: HI-VOL

ANALYSIS METHOD: GRAVIMETRIC

		JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
	1	9999 W	148 S	9999 S	9999 T	9999 T	93 S	55 T	9999 F	9999 M	9999 W	9999 S	9999 M
	2	171 T	9999 S	9999 S	9999 W	126 F	9999 M	9999 W	9999 S	9999 T	9999 T	9999 S	9999 T
D	3	9999 F	9999 M	572*M	9999 T	9999 S	9999 T	9999 T	9999 S	9999 W	9999 F	9999 M	9999 W
	4	9999 S	9999 T	9999 T	9999 F	9999 S	9999 W	9999 F	9999 M	9999 T	9999 S	148 T	347*T
A	5	9999 S	9999 W	9999 W	9999 S	9999 M	9999 T	9999 S	9999 T	79 F	137 S	9999 W	9999 F
	6	9999 M	9999 T	9999 T	9999 S	9999 T	9999 F	9999 S	84 W	9999 S	9999 M	9999 T	9999 S
Y	7	9999 T	488*F	9999 F	9999 M	9999 W	55 S	48 M	9999 T	9999 S	9999 T	9999 F	9999 S
	8	90 W	9999 S	9999 S	9999 T	9999 T	9999 S	9999 T	9999 F	9999 M	9999 W	9999 S	9999 M
	9	9999 T	9999 S	206 S	9999 W	9999 F	9999 M	9999 W	9999 S	9999 T	9999 T	9999 S	9999 T
	10	9999 F	9999 M	9999 M	9999 T	9999 S	9999 T	9999 T	9999 S	9999 W	9999 F	147 M	128 W
C	11	9999 S	9999 T	9999 T	9999 F	9999 S	9999 W	9999 F	9999 M	91 T	124 S	9999 T	9999 T
	12	9999 S	9999 W	9999 W	9999 S	9999 M	9999 T	9999 S	100 T	9999 F	9999 S	9999 W	9999 F
F	13	9999 M	86 T	9999 T	9999 S	9999 T	90 F	29 S	9999 W	9999 S	9999 M	9999 T	9999 S
	14	275*T	9999 F	9999 F	95 M	9999 W	9999 S	9999 M	9999 T	9999 S	9999 T	9999 F	9999 S
	15	9999 W	9999 S	287*S	9999 T	9999 T	9999 S	9999 T	9999 F	9999 M	9999 W	9999 S	9999 M
	16	9999 T	9999 S	9999 S	9999 W	9999 F	9999 M	9999 W	9999 S	9999 T	9999 T	101 S	115 T
M	17	9999 F	9999 M	9999 M	9999 T	9999 S	9999 T	9999 T	9999 S	101 W	156 F	9999 M	9999 W
	18	9999 S	9999 T	9999 T	9999 F	9999 S	9999 W	9999 F	137 M	9999 T	9999 S	9999 T	9999 T
O	19	9999 S	113 W	9999 W	9999 S	9999 M	38 T	61 S	9999 T	9999 F	9999 S	9999 W	9999 F
	20	137 M	9999 T	9999 T	85 S	44 T	9999 F	9999 S	9999 W	9999 S	9999 M	9999 T	9999 S
N	21	9999 T	9999 F	155 T	9999 M	9999 W	9999 S	9999 M	9999 T	9999 S	9999 T	9999 F	9999 S
	22	9999 W	9999 S	9999 S	9999 T	9999 T	9999 S	9999 T	9999 F	9999 M	9999 W	89 S	232 M
T	23	9999 T	9999 S	9999 S	9999 W	9999 F	9999 M	9999 W	9999 S	135 T	182 T	9999 S	9999 T
	24	9999 F	9999 M	9999 M	9999 T	9999 S	9999 T	9999 T	51 S	9999 W	9999 F	9999 M	9999 W
H	25	9999 S	137 T	9999 T	9999 F	9999 S	82 W	57 F	9999 M	9999 T	9999 S	9999 T	9999 T
	26	156 S	W	9999 W	64 S	56 M	T	9999 S	9999 T	9999 F	9999 S	9999 W	9999 F
	27	M	T	180 T	S	T	F	9999 S	9999 W	9999 S	9999 M	9999 T	9999 S
	28	T	F	F	M	W	S	9999 M	9999 T	9999 S	9999 T	132 F	122 S
	29	W		S	T	T	S	9999 T	9999 F	49 M	206 W	S	M
	30	T		S	W	F	M	9999 W	25 S	T	T	S	T
	31	F		M		S		89 T	S		F		W
	#	5	5	3	3	3	5	6	5	5	5	5	5
	MAX	275	488	572	95	126	93	89	137	135	206	148	347
GEO	MEAN	156	158	255	80	68	68	54	68	86	158	121	171

TOTAL SAMPLES = 57 MAXIMUM = 572
GEOMETRIC MEAN = 109 TOTAL PRIMARY EXCEEDANCES = 5
GEOMETRIC STANDARD DEVIATION = 1.80 TOTAL SECONDARY EXCEEDANCES = 14
*** MEAN EXCEEDS PRIMARY STANDARD AND EXCEEDS SECONDARY STANDARD OF 75 AND 60 MICROGRAMS PER CUBIC METER, RESPECTIVELY

* INDICATES ITEM EXCEEDED PRIMARY STANDARD OF 260 MICROGRAMS PER CUBIC METER
+ INDICATES ITEM EXCEEDED SECONDARY STANDARD OF 150 MICROGRAMS PER CUBIC METER

FIGURE AP-10-H

AQUMS-II STANDARDS REPORT FROM JAN 1986 TO DEC 1986
L E A D
DAILY VALUES

REPORT DATE: MAY 6, 1987

STATE (27): MONTANA

SITE CODE: 27-0160-719
AGENCY (F): STATE
PROJECT (02): SOURCE-ORIENTED AMBIENT SURV.
CITY POPULATION:
AQCR POPULATION:
EPA REGION: 8
SUPPORTING AGENCY: MONTANA AIR QUALITY BUREAU

LOCATION: EAST HELENA
COUNTY (060): LEWIS & CLARK
SITE ADDR: HADFIELD - 101 WEST MAIN
STATION TYPE (21): SUBURBAN: INDUSTRIAL
AQCR: 142 SMSA: 0000
SLAMS/NAMS ID (2): SLAMS

LATITUDE: N46 D. 35 M. 22 S.
LONGITUDE: W111 D. 55 M. 25 S.
UTM ZONE: 12
UTM NORTHING: 5159.7400 M.
UTM EASTING: 429.3200 M.
ELEVATION ABOVE GROUND: 3.0 M.
ELEVATION ABOVE MSL: 3,900 FT.
TIME ZONE: MOUNTAIN

COLLECTION METHOD: HI-VOL

ANALYSIS METHOD: EMISSION SPECTRA ICAP

		JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
	1	999.900$W	1.570 S	999.900$S	999.900$T	999.900$T	1.610 S	1.360 T	999.900$F	999.900$M	999.900$W	2.550 S	5.190 M
	2	3.710 T	999.900$S	999.900$S	0.300 W	1.370 F	999.900$M	999.900$W	999.900$S	1.400 T	0.110 T	999.900$S	999.900$T
D	3	999.900$F	999.900$M	5.320 M	999.900$T	999.900$S	999.900$T	999.900$T	1.800 S	999.900$W	999.900$F	999.900$M	999.900$W
	4	999.900$S	2.530 T	999.900$T	999.900$F	999.900$S	1.880 W	0.010 F	999.900$M	999.900$T	999.900$S	5.670 T	3.950 T
A	5	1.580 S	999.900$W	999.900$W	1.550 S	0.100 M	999.900$T	999.900$S	999.900$T	0.100 F	1.340 S	999.900$W	999.900$F
	6	999.900$M	999.900$T	1.420 T	999.900$S	999.900$T	999.900$F	999.900$S	1.090 W	999.900$S	999.900$M	999.900$T	999.900$S
Y	7	999.900$T	2.150 F	999.900$F	999.900$M	999.900$W	0.260 S	1.700 M	999.900$T	999.900$S	999.900$T	0.600 F	0.710 S
	8	5.440 W	999.900$S	999.900$S	3.320 T	0.080 T	999.900$S	999.900$T	999.900$F	0.580 M	3.630 W	999.900$S	999.900$M
	9	999.900$T	999.900$S	0.560 S	999.900$W	999.900$F	999.900$M	999.900$W	0.100 S	999.900$T	999.900$T	999.900$S	999.900$T
	10	999.900$F	1.330 M	999.900$M	999.900$T	999.900$S	1.170 T	0.170 T	999.900$S	999.900$W	999.900$F	0.750 M	2.010 W
O	11	1.380 S	999.900$T	999.900$T	0.540 F	0.150 S	999.900$W	999.900$F	999.900$M	3.180 T	5.520 S	999.900$T	999.900$T
	12	999.900$S	999.900$W	1.580 W	999.900$S	999.900$M	999.900$T	999.900$S	0.800 T	999.900$F	999.900$S	999.900$W	999.900$F
F	13	999.900$M	0.170 T	999.900$T	999.900$S	999.900$T	0.610 F	1.500 S	999.900$W	999.900$S	999.900$M	0.830 T	0.690 S
	14	4.180 T	999.900$F	999.900$F	999.900$M	0.880 W	999.900$S	999.900$M	999.900$T	0.050 S	9.800 T	999.900$F	999.900$S
	15	999.900$W	999.900$S	1.340 S	999.900$T	999.900$T	999.900$S	999.900$T	2.450 F	999.900$M	999.900$W	999.900$S	999.900$M
	16	999.900$T	0.500 S	999.900$S	999.900$W	999.900$F	4.750 M	0.480 W	999.900$S	999.900$T	999.900$T	0.810 S	4.780 T
M	17	0.620 F	999.900$M	999.900$M	0.390 T	0.790 S	999.900$T	999.900$T	999.900$S	0.250 W	8.820 F	999.900$M	999.900$W
	18	999.900$S	999.900$T	1.080 T	999.900$F	999.900$S	999.900$W	999.900$F	2.710 M	999.900$T	999.900$S	999.900$T	999.900$T
D	19	999.900$S	1.080 W	999.900$W	999.900$S	999.900$M	0.260 T	0.830 S	999.900$T	999.900$F	999.900$S	1.450 W	3.860 F
	20	0.250 M	999.900$T	999.900$T	0.250 S	1.750 T	999.900$F	999.900$S	999.900$W	0.050 S	5.420 M	999.900$T	999.900$S
N	21	999.900$T	999.900$F	4.530 F	999.900$M	999.900$W	999.900$S	999.900$M	1.050 T	999.900$S	999.900$T	999.900$F	999.900$S
	22	999.900$W	0.240 S	999.900$S	999.900$T	999.900$T	0.320 S	3.240 T	999.900$F	999.900$M	999.900$W	2.200 S	2.320 M
T	23	0.710 T	999.900$S	999.900$S	0.210 W	0.130 F	999.900$M	999.900$W	999.900$S	8.200 T	11.430 T	999.900$S	999.900$T
	24	999.900$F	999.900$M	0.850 M	999.900$T	999.900$S	999.900$T	999.900$T	0.870 S	999.900$W	999.900$F	999.900$M	999.900$W
H	25	999.900$S	0.950 T	999.900$T	999.900$F	999.900$S	2.460 W	5.890 F	999.900$M	999.900$T	999.900$S	1.920 T	1.260 T
	26	0.860 S	999.900$W	999.900$W	0.240 S	0.200 M	999.900$T	999.900$S	999.900$T	1.380 F	1.720 S	999.900$W	999.900$F
	27	999.900$M	999.900$T	11.670 T	999.900$S	999.900$T	999.900$F	999.900$S	4.150 W	999.900$S	999.900$M	999.900$T	999.900$S
	28	999.900$T	3.770 F	999.900$F	999.900$M	999.900$W	0.550 S	1.930 M	999.900$T	999.900$S	999.900$T	3.050 F	7.760 S
	29	0.540 W		999.900$S	1.150 T	5.320 T	S	999.900$T	999.900$F	0.430 M	5.000 W	S	999.900$M
	30	T		1.280 S	W	F	M	999.900$W	5.810 S	T	T	S	999.900$T
	31	F		M		S		3.670 T	S		F		9.680 W
	#			30			29			31			31
	MAX			11.670			5.320			8.200			11.430
ARITH MEAN				2.090			1.136			1.865			3.704

TOTAL SAMPLES = 121

MAXIMUM = 11.670
TOTAL PRIMARY EXCEEDANCES = 5

*** AT LEAST ONE QUARTERLY MEAN EXCEEDS PRIMARY STANDARD OF 1.500 MICROGRAMS PER CUBIC METER

$ INDICATES ITEM HAS TO BE MULTIPLIED BY IT TO OBTAIN THE CORRECT VALUE. EXAMPLE: AN ITEM PRINTED AS 24.3$ WOULD = 243.0

FIGURE AP-11-H

APPENDIX I

Air Quality Data Plots

APPENDIX I

AIR QUALITY DATA PLOTS

This appendix shows a sampling of plots and histograms that can be generated using air quality data.

The list is as follows:

TSP - One Year Plots

AP-1-I	Billings - City Hall - 1986
AP-2-I	Great Falls - Fire Station #1 - 1986
AP-3-I	Butte - Greeley School - 1986
AP-4-I	Libby - Lincoln County Courthouse - 1986
AP-5-I	Eureka - Lincoln Electric - Co-op - 1986

TSP - Three Year Plots

AP-6-I	Libby - Lincoln County Courthouse - 1984-86
AP-7-I	Missoula - Boyd Park - 1984-86
AP-8-I	Kalispell - Universal Athletics - 1984-86

Carbon Monoxide - Diurnal

AP-9-I	Missoula - Malfunction Junction - August 1986
AP-10-I	Great Falls - Pardis Clinic - December 1986

Sulfur Dioxide - Diurnal

AP-11-I	Billings - Lockwood Park - January 1986
AP-12-I	Billings - Coburn Road - August 1986

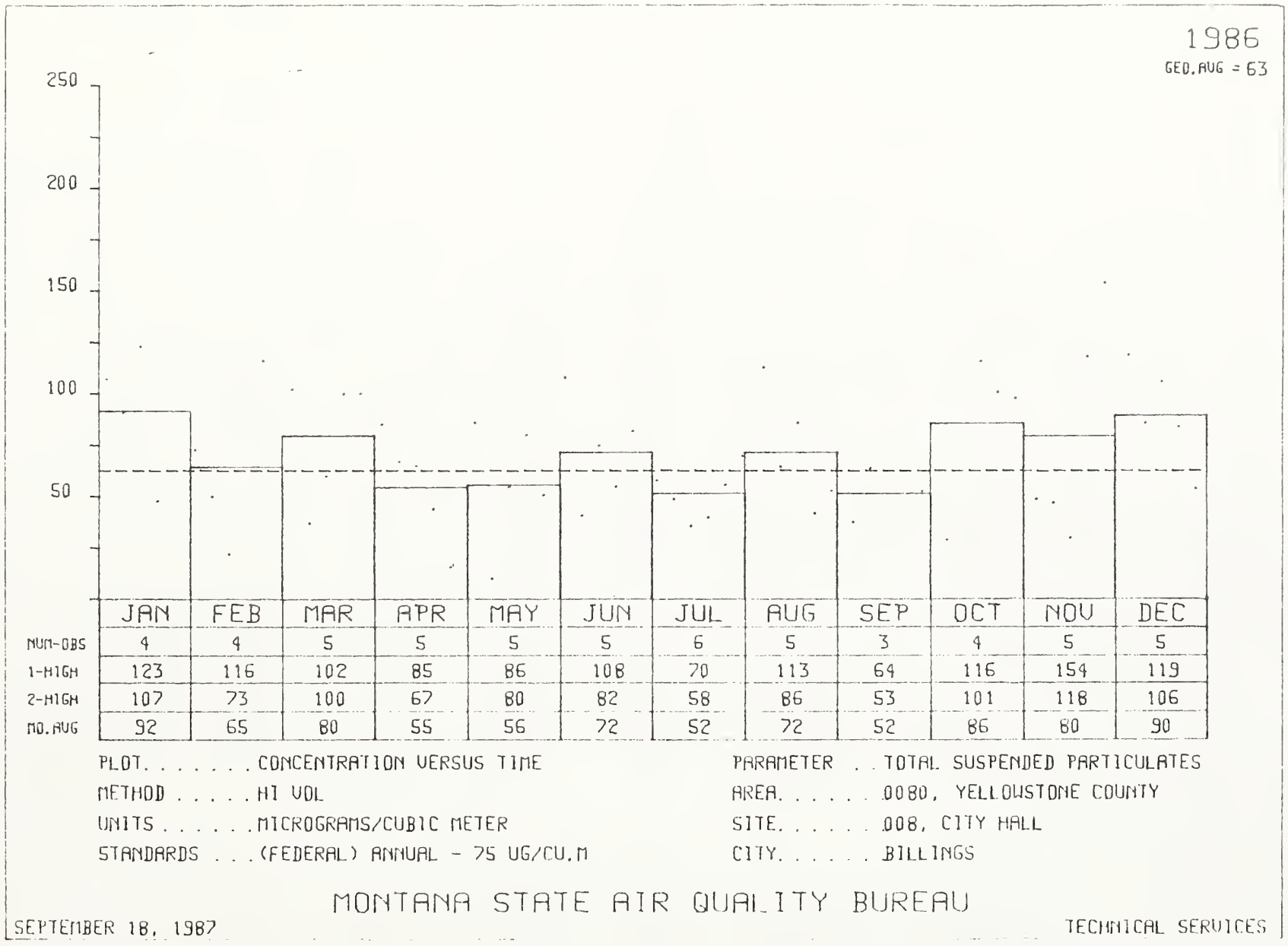
Lead - One Year Plots

AP-13-I	East Helena - Firehall - 1986
AP-14-I	East Helena - Hadfield - 1986

Lead - Three Year Plots

AP-15-I	East Helena - Firehall - 1984-86
AP-16-I	East Helena - Hadfield - 1984-86

FIGURE AP-1-1



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NUM-OBS	4	4	5	5	5	5	6	5	3	4	5	5
1-HIGH	123	116	102	85	86	108	70	113	64	116	154	119
2-HIGH	107	73	100	67	80	82	58	86	53	101	118	106
NO.AVG	92	65	80	55	56	72	52	72	52	86	80	90

PLOT. . . . . CONCENTRATION VERSUS TIME
METHOD . . . . . HI VOL
UNITS . . . . . MICROGRAMS/CUBIC METER
STANDARDS . . . (FEDERAL) ANNUAL - 75 UG/CU.M

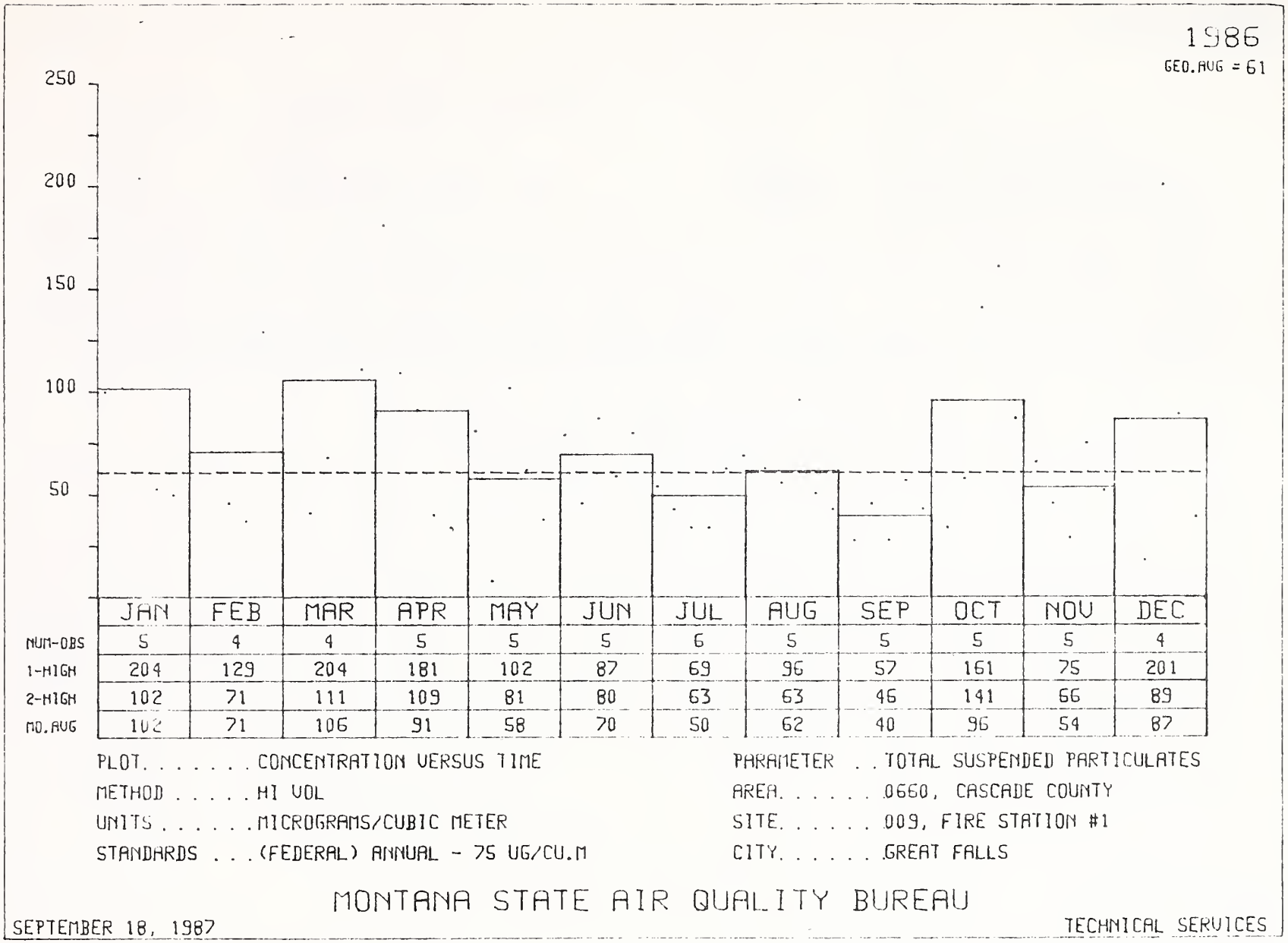
PARAMETER . . TOTAL SUSPENDED PARTICULATES
AREA. . . . . 0080, YELLOWSTONE COUNTY
SITE. . . . . 008, CITY HALL
CITY. . . . . BILLINGS

MONTANA STATE AIR QUALITY BUREAU

SEPTEMBER 18, 1987

TECHNICAL SERVICES

FIGURE AP-2-I



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NUM-OBS	5	4	4	5	5	5	6	5	5	5	5	4
1-HIGH	204	129	204	181	102	87	69	96	57	161	75	201
2-HIGH	102	71	111	109	81	80	63	63	46	141	66	89
MO.AVG	102	71	106	91	58	70	50	62	40	96	54	87

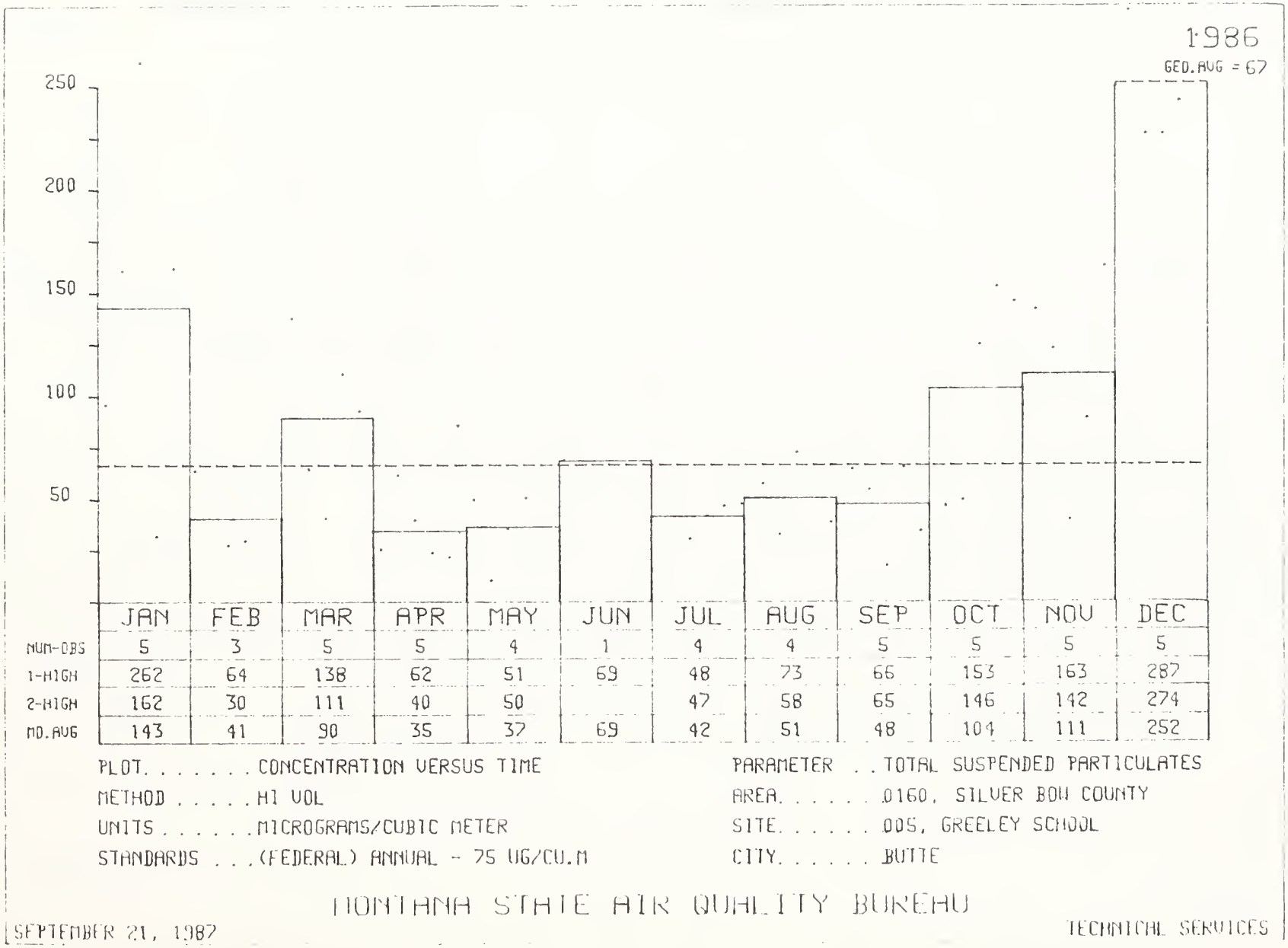
PLOT. . . . . CONCENTRATION VERSUS TIME
METHOD . . . . . HI VOL
UNITS . . . . . MICROGRAMS/CUBIC METER
STANDARDS . . . (FEDERAL) ANNUAL - 75 UG/CU.M

PARAMETER . . TOTAL SUSPENDED PARTICULATES
AREA. . . . . 0660, CASCADE COUNTY
SITE. . . . . 009, FIRE STATION #1
CITY. . . . . GREAT FALLS

MONTANA STATE AIR QUALITY BUREAU

SEPTEMBER 18, 1987 TECHNICAL SERVICES

FIGURE AP-3-I



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NUM-OBS	5	3	5	5	4	1	4	4	5	5	5	5
1-HIGH	262	64	138	62	51	69	48	73	66	153	163	287
2-HIGH	162	30	111	40	50		47	58	65	146	142	274
MD.AVG	143	41	90	35	37	69	42	51	48	104	111	252

PLOT. . . . . CONCENTRATION VERSUS TIME
METHOD . . . . . HI VOL
UNITS . . . . . MICROGRAMS/CUBIC METER
STANDARDS . . . (FEDERAL) ANNUAL - 75 UG/CU.M

PARAMETER . . TOTAL SUSPENDED PARTICULATES
AREA. . . . . 0160, SILVER BOW COUNTY
SITE. . . . . 005, GREELEY SCHOOL
CITY. . . . . BUTTE

MONTANA STATE AIR QUALITY BUREAU

SEPTEMBER 21, 1987

TECHNICAL SERVICES

FIGURE AP-4-I

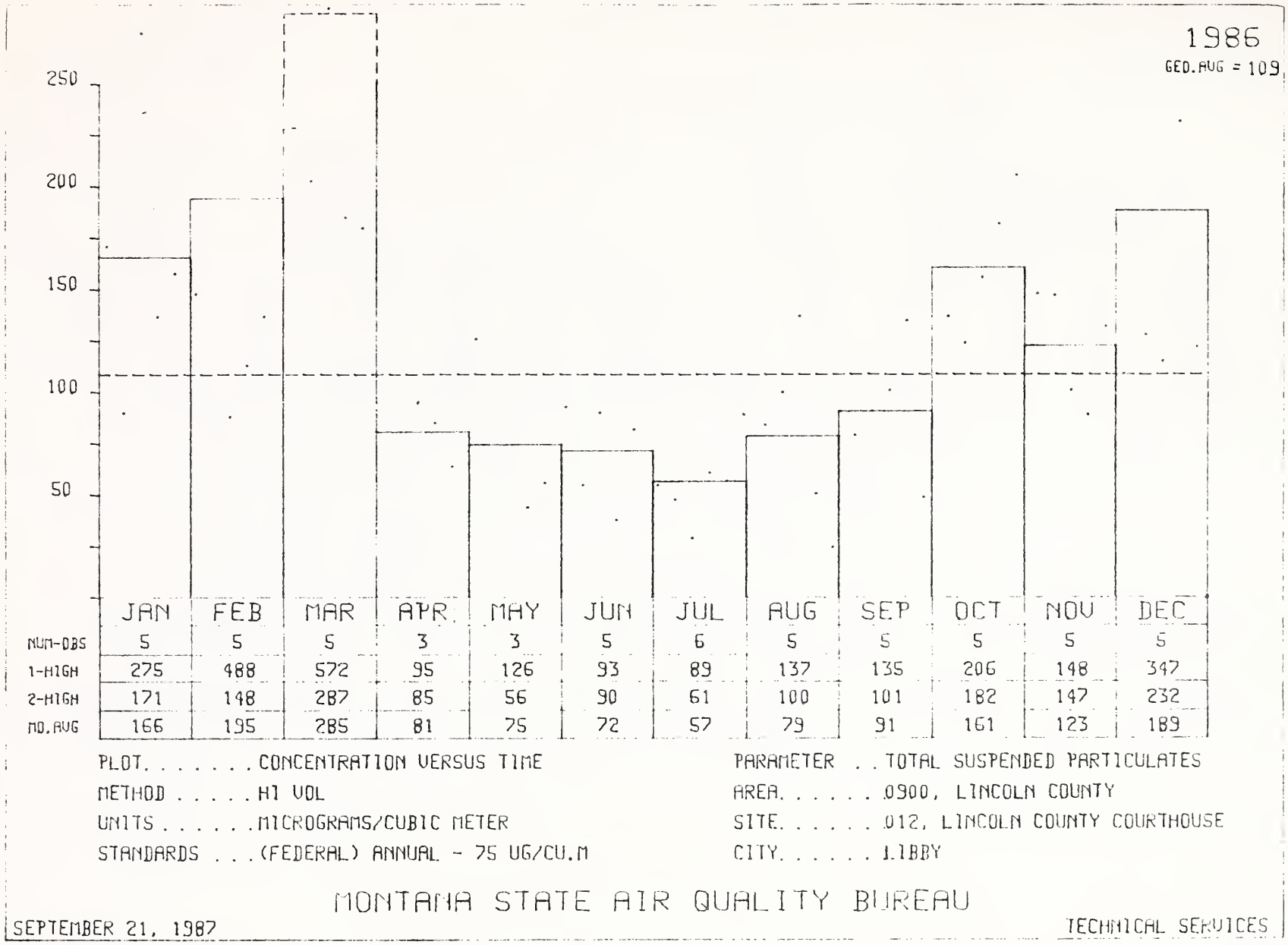

1986
GEO.AVG = 109
250
200
150
100
50
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
NUM-OBS 5 5 5 3 3 5 6 5 5 5 5 5
1-HIGH 275 488 572 95 126 93 89 137 135 206 148 347
2-HIGH 171 148 287 85 56 90 61 100 101 182 147 232
NO.AVG 166 195 285 81 75 72 57 79 91 161 123 189
PLOT. . . . . CONCENTRATION VERSUS TIME
METHOD . . . . . HI VOL
UNITS . . . . . MICROGRAMS/CUBIC METER
STANDARDS . . . (FEDERAL) ANNUAL - 75 UG/CU.M
PARAMETER . . TOTAL SUSPENDED PARTICULATES
AREA. . . . . 0900, LINCOLN COUNTY
SITE. . . . . 012, LINCOLN COUNTY COURTHOUSE
CITY. . . . . LIBBY
MONTANA STATE AIR QUALITY BUREAU
SEPTEMBER 21, 1987
TECHNICAL SERVICES

FIGURE AP-5-I

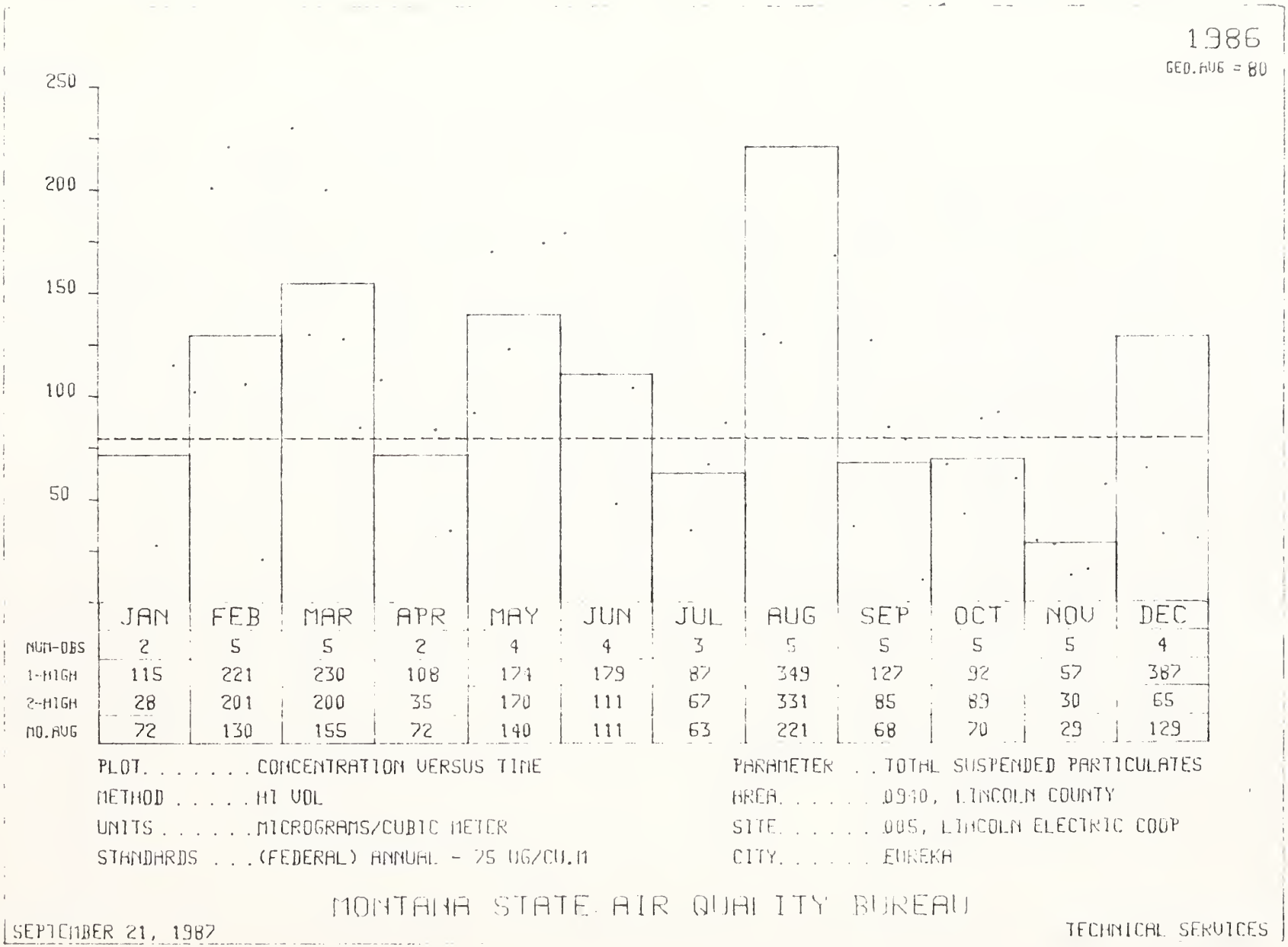
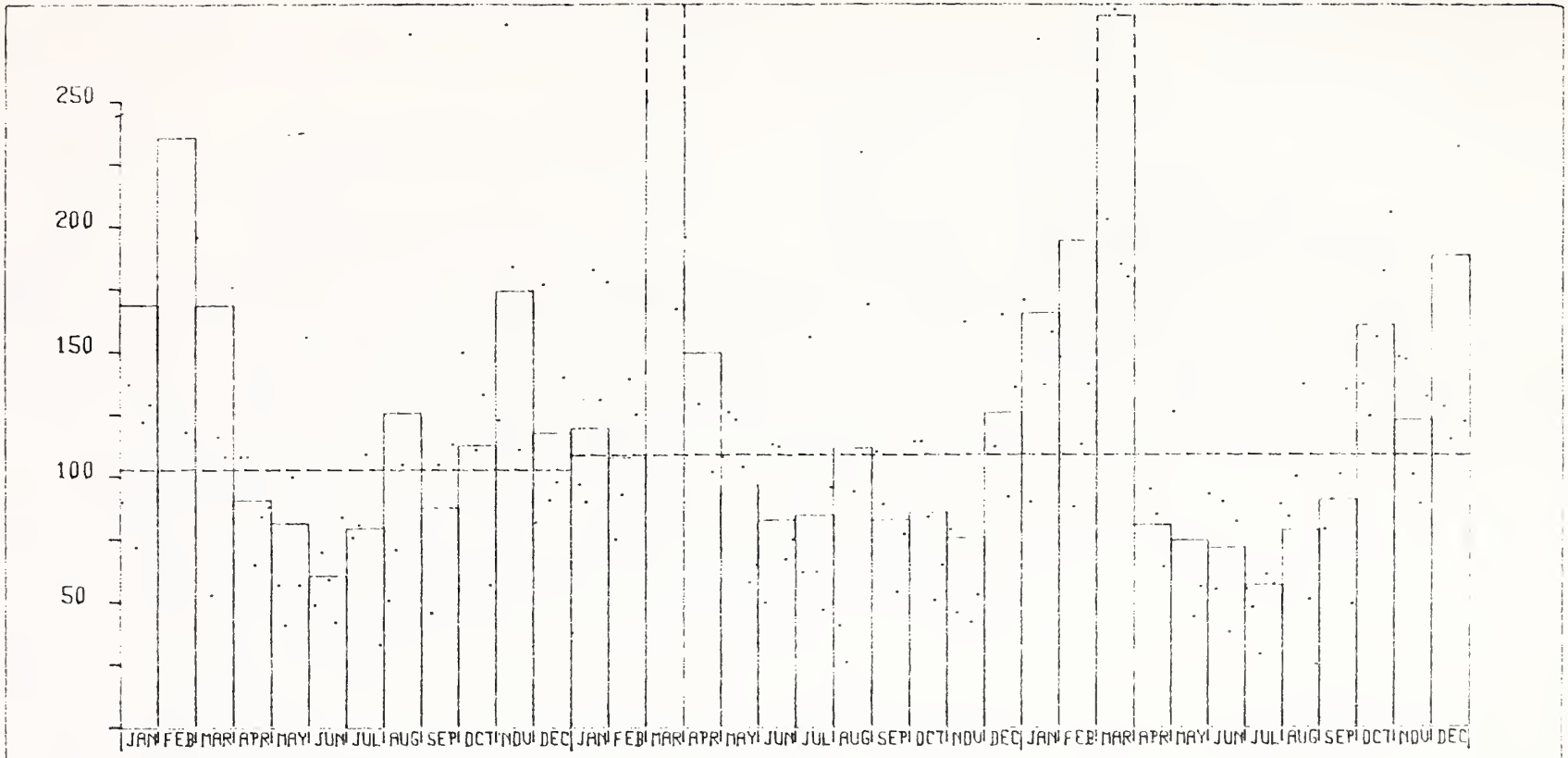

1986
GED.AUG = 80
250
200
150
100
50
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
NUM-OBS 2 5 5 2 4 4 3 5 5 5 5 4
1-HIGH 115 221 230 108 174 179 87 349 127 92 57 387
2-HIGH 28 201 200 35 170 111 67 331 85 83 30 65
NO.AVG 72 130 155 72 140 111 63 221 68 70 29 129
PLOT. . . . . CONCENTRATION VERSUS TIME
METHOD . . . . . HI VOL
UNITS . . . . . MICROGRAMS/CUBIC METER
STANDARDS . . . (FEDERAL) ANNUAL - 75 UG/CU.M
PARAMETER . . TOTAL SUSPENDED PARTICULATES
AREA. . . . . 0940, LINCOLN COUNTY
SITE. . . . . 005, LINCOLN ELECTRIC COOP
CITY. . . . . EUREKA
MONTANA STATE AIR QUALITY BUREAU
SEPTEMBER 21, 1987
TECHNICAL SERVICES

FIGURE AP-6-I



NUM OBS	12	4	12	10	10	10	10	8	6	8	8	10	12	8	8	5	6	5	5	5	4	5	5	4	5	5	5	3	3	5	6	5	5	5	5	5
MO.AVG	169	236	169	91	82	61	80	126	88	113	175	118	120	108	410	150	97	83	85	112	83	86	76	126	166	195	285	81	75	72	57	79	91	161	123	189
GED.AVG	103												109												109											

PLOT. . . . . CONCENTRATION VERSUS TIME
METHOD . . . . . HI VOL
UNITS . . . . . MICROGRAMS/CUBIC METER
STANDARDS . . . (FEDERAL) ANNUAL - 75 UG/CU.M

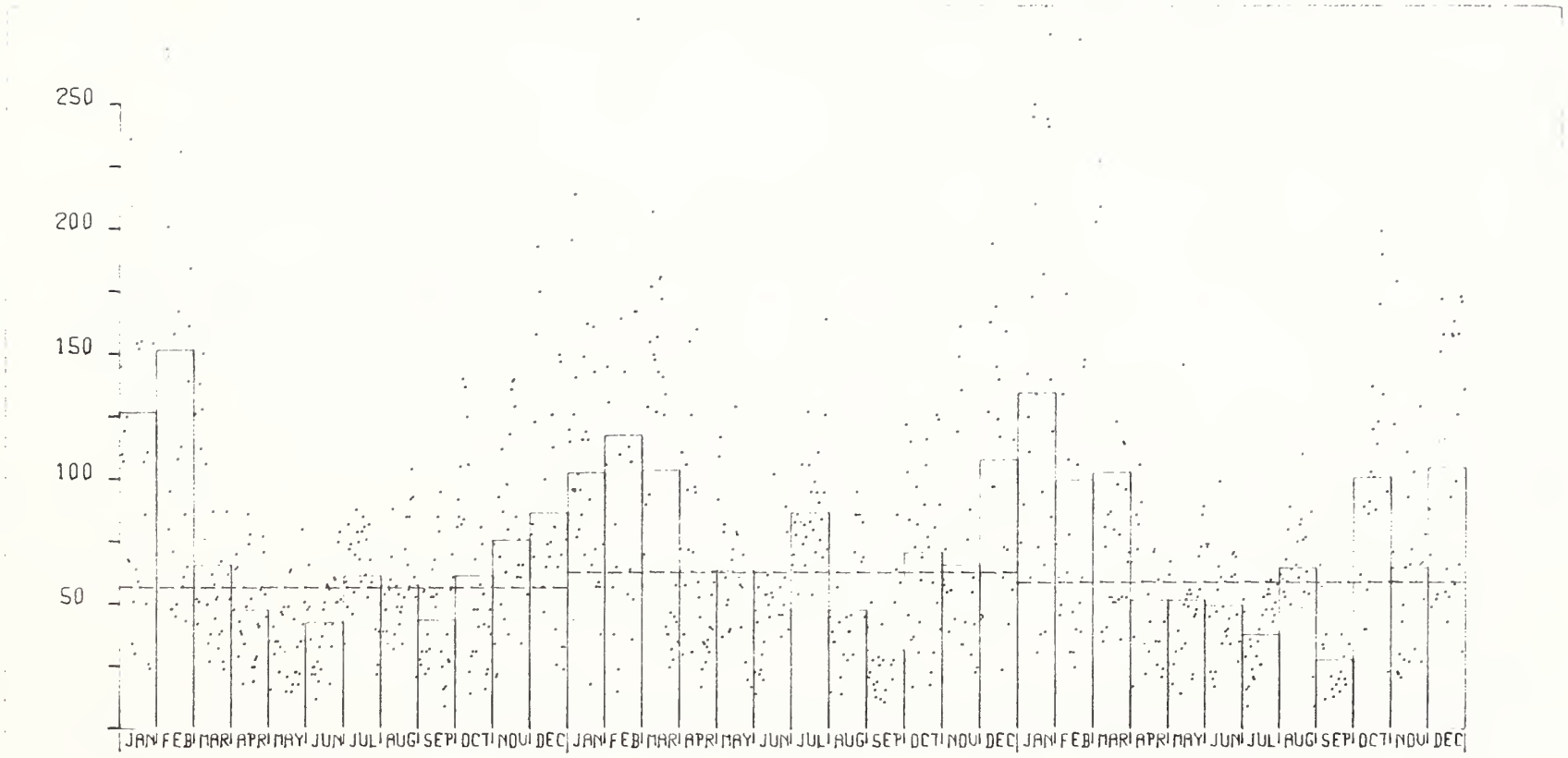
PARAMETER . . TOTAL SUSPENDED PARTICULATES
AREA. . . . . 0900, LINCOLN COUNTY
SITE. . . . . 012, LINCOLN CO COURTHOUSE
CITY. . . . . LIBBY

MONTANA STATE AIR QUALITY BUREAU

AUGUST 25, 1987

TECHNICAL SERVICES

FIGURE AP-7-I


250
200
150
100
50
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
1984
1985
1986

NUM OBS	26	28	29	29	28	30	27	30	30	30	27	27	30	23	29	30	24	26	30	24	23	30	23	23	24	22	29	23	27	28	29	24	18	21	27	27
MO.AVG	127	152	66	98	36	93	62	58	44	62	76	87	103	118	109	64	64	98	87	98	32	71	66	108	135	100	103	52	52	50	38	65	28	101	65	105
GEO.AVG							57												63												59					

PLOT. . . . . CONCENTRATION VERSUS TIME
METHOD . . . . . HI VOL
UNITS . . . . . MICROGRAMS/CUBIC METER
STANDARDS . . . (FEDERAL) ANNUAL - 75 UG/CU.M

PARAMETER . . TOTAL SUSPENDED PARTICULATES
AREA. . . . . 1100, MISSOULA COUNTY
SITE. . . . . 024, BOYD PARK
CITY. . . . . MISSOULA

MONTANA STATE AIR QUALITY BUREAU

AUGUST 25, 1987

TECHNICAL SERVICES

FIGURE AP-8-I

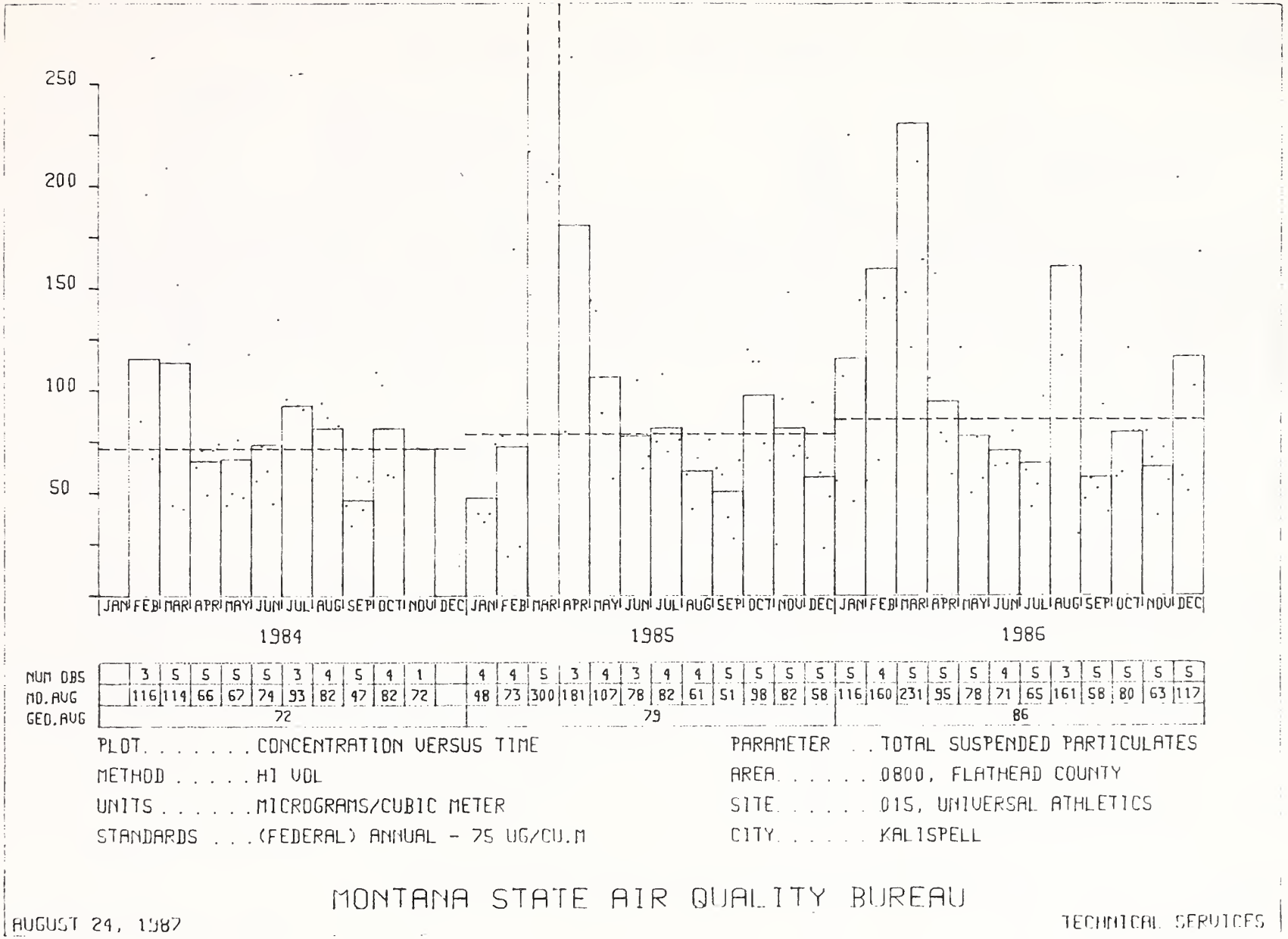
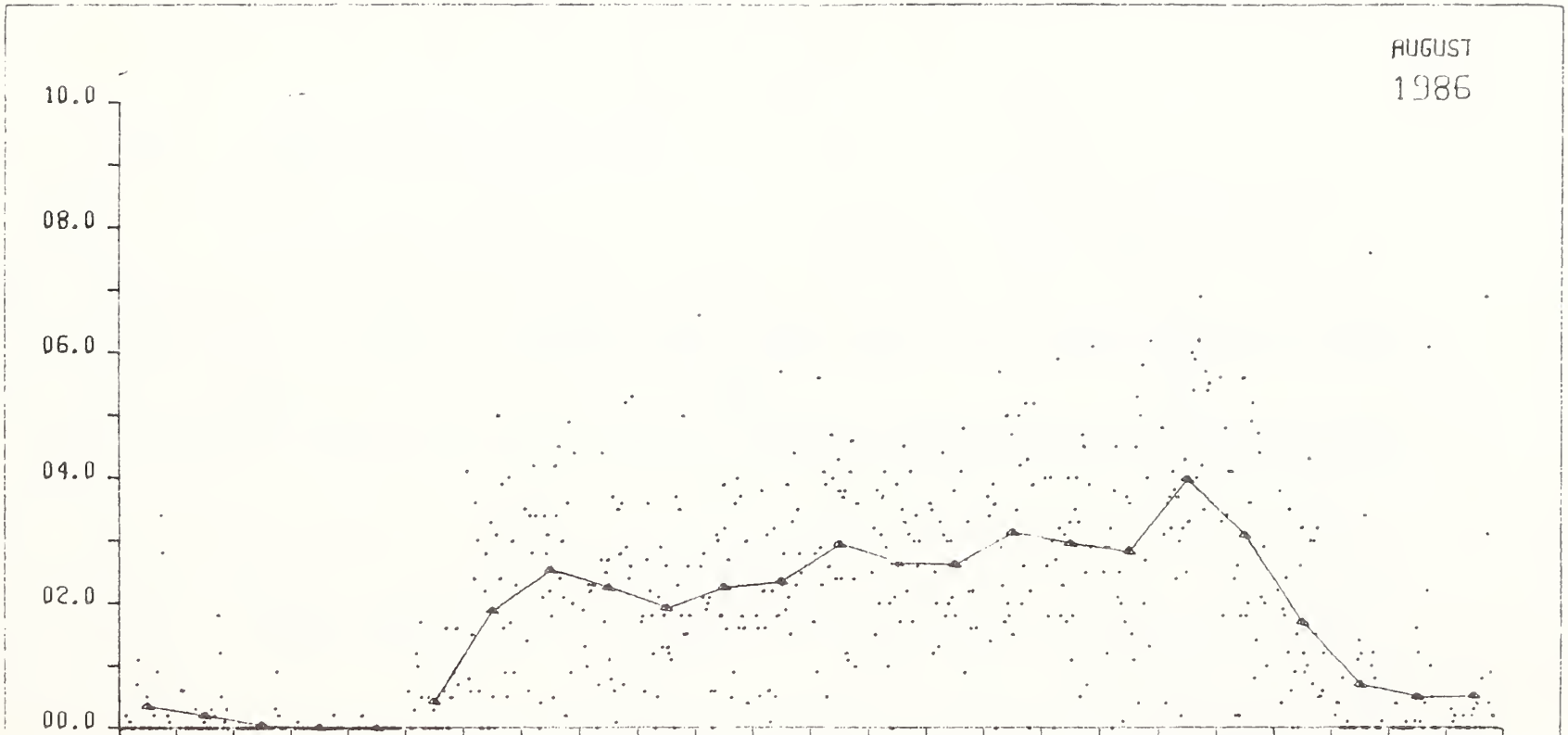

250
200
150
100
50
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
1984
1985
1986
NUM OBS 3 5 5 5 5 3 4 5 4 1 4 4 5 3 4 3 4 4 5 5 5 5 5 4 5 5 5 4 5 3 5 5 5 5
MO.AVG 116 114 66 67 74 93 82 47 82 72 98 73 300 181 107 78 82 61 51 98 82 58 116 160 231 95 78 71 65 161 58 80 63 117
GEO.AVG 72 79 86
PLOT. . . . . CONCENTRATION VERSUS TIME
METHOD . . . . . HI VOL
UNITS . . . . . MICROGRAMS/CUBIC METER
STANDARDS . . . (FEDERAL) ANNUAL - 75 UG/CU.M
PARAMETER . . TOTAL SUSPENDED PARTICULATES
AREA. . . . . 0800, FLATHEAD COUNTY
SITE. . . . . 015, UNIVERSAL ATHLETICS
CITY. . . . . KALISPELL
MONTANA STATE AIR QUALITY BUREAU
AUGUST 24, 1987
TECHNICAL SERVICES

FIGURE AP-9-I



	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
NUM-OBS	29	29	29	29	29	29	29	28	28	28	28	27	27	28	27	28	28	28	28	28	28	28	28	28
1-HIGH	3.40	1.80	.900	.200	.200	1.70	5.00	4.90	5.30	5.00	6.60	5.70	5.60	4.50	4.80	5.70	6.10	6.20	6.90	5.60	4.30	7.60	6.10	6.90
2-HIGH	2.80	1.20	.300	.100		1.60	4.10	4.50	5.20	3.70	4.00	4.40	4.70	4.10	4.40	5.20	5.90	5.80	6.20	5.60	3.80	3.40	2.20	3.10
HR.AVG	.352	.207	.052	.010	.00	.431	1.88	2.54	2.26	1.93	2.26	2.36	2.94	2.66	2.63	3.13	2.96	2.83	3.97	3.08	1.70	.704	.507	.525

PLOT. . . . . CONCENTRATION VERSUS TIME (MON-SUN)
METHOD . . . . . NON-DISPERSIVE INFARED
UNITS . . . . . PARTS PER MILLION
STANDARDS . . . (STATE) .50 PPM 1-HR AVG

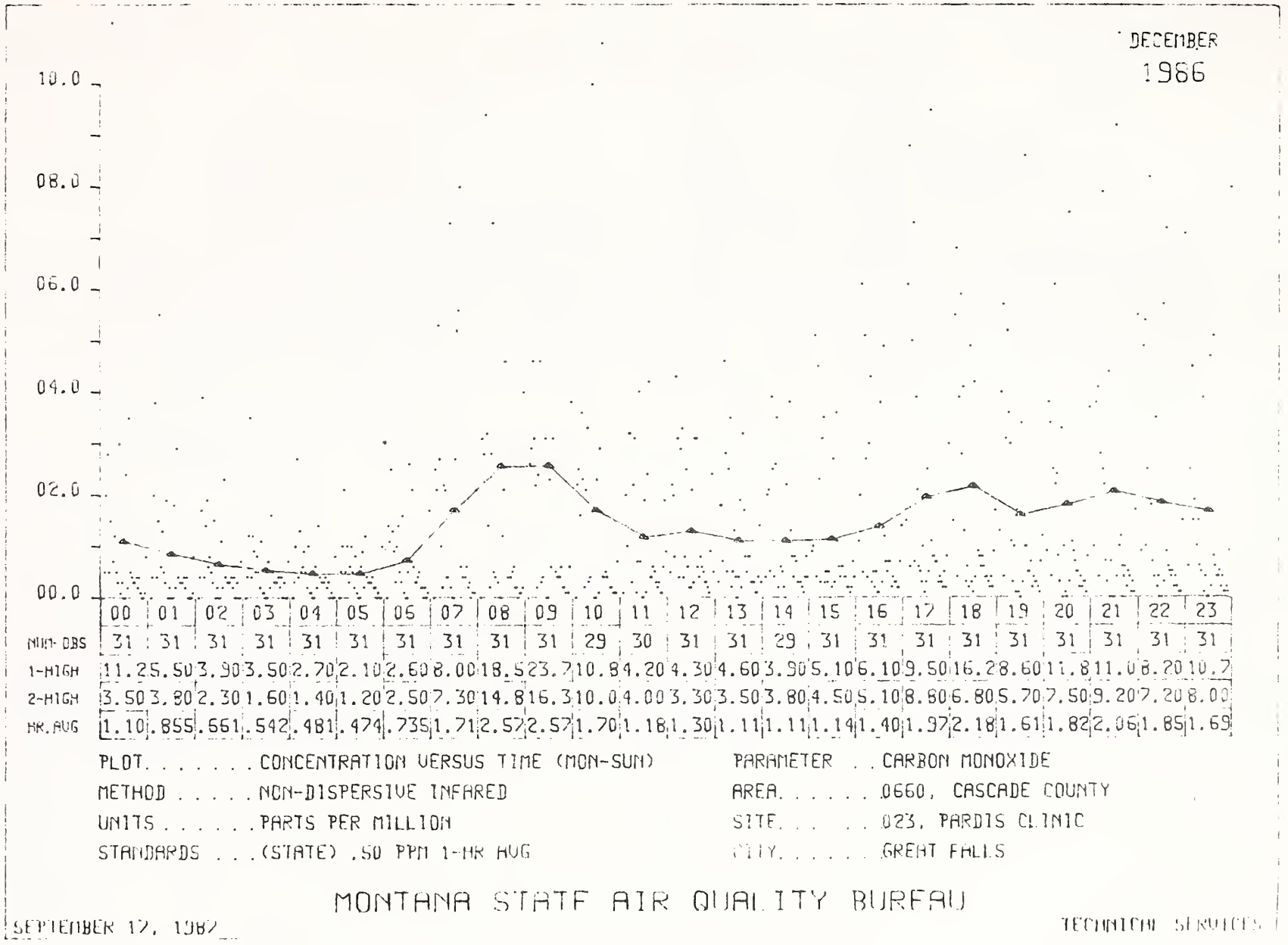
PARAMETER . . CARBON MONOXIDE
AREA. . . . . 1080, MISSOULA COUNTY
SITE. . . . . 005, MALFUNCTION JUNCTION
CITY. . . . . MISSOULA

MONTANA STATE AIR QUALITY BUREAU

SEPTEMBER 22, 1987

TECHNICAL SERVICES

FIGURE AP-10-I



	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
NUM OBS	31	31	31	31	31	31	31	31	31	31	29	30	31	31	29	31	31	31	31	31	31	31	31	31
1-HIGH	11.2	5.50	3.90	3.50	2.70	2.10	2.60	8.00	18.5	23.7	10.8	4.20	4.30	4.60	3.90	5.10	6.10	9.50	16.2	8.60	11.8	11.0	8.20	10.2
2-HIGH	3.50	3.80	2.30	1.60	1.40	1.20	2.50	7.30	14.8	16.3	10.0	4.00	3.30	3.50	3.80	4.50	5.10	8.80	6.80	5.70	7.50	9.20	7.20	8.00
HR.AVG	1.10	.855	.661	.542	.481	.474	.735	1.71	2.57	2.57	1.70	1.18	1.30	1.11	1.11	1.14	1.40	1.97	2.18	1.61	1.82	2.06	1.85	1.69

PLOT. . . . . CONCENTRATION VERSUS TIME (MON-SUN)
METHOD . . . . . NON-DISPERSIVE INFARED
UNITS . . . . . PARTS PER MILLION
STANDARDS . . . (STATE) .50 PPM 1-HR AVG

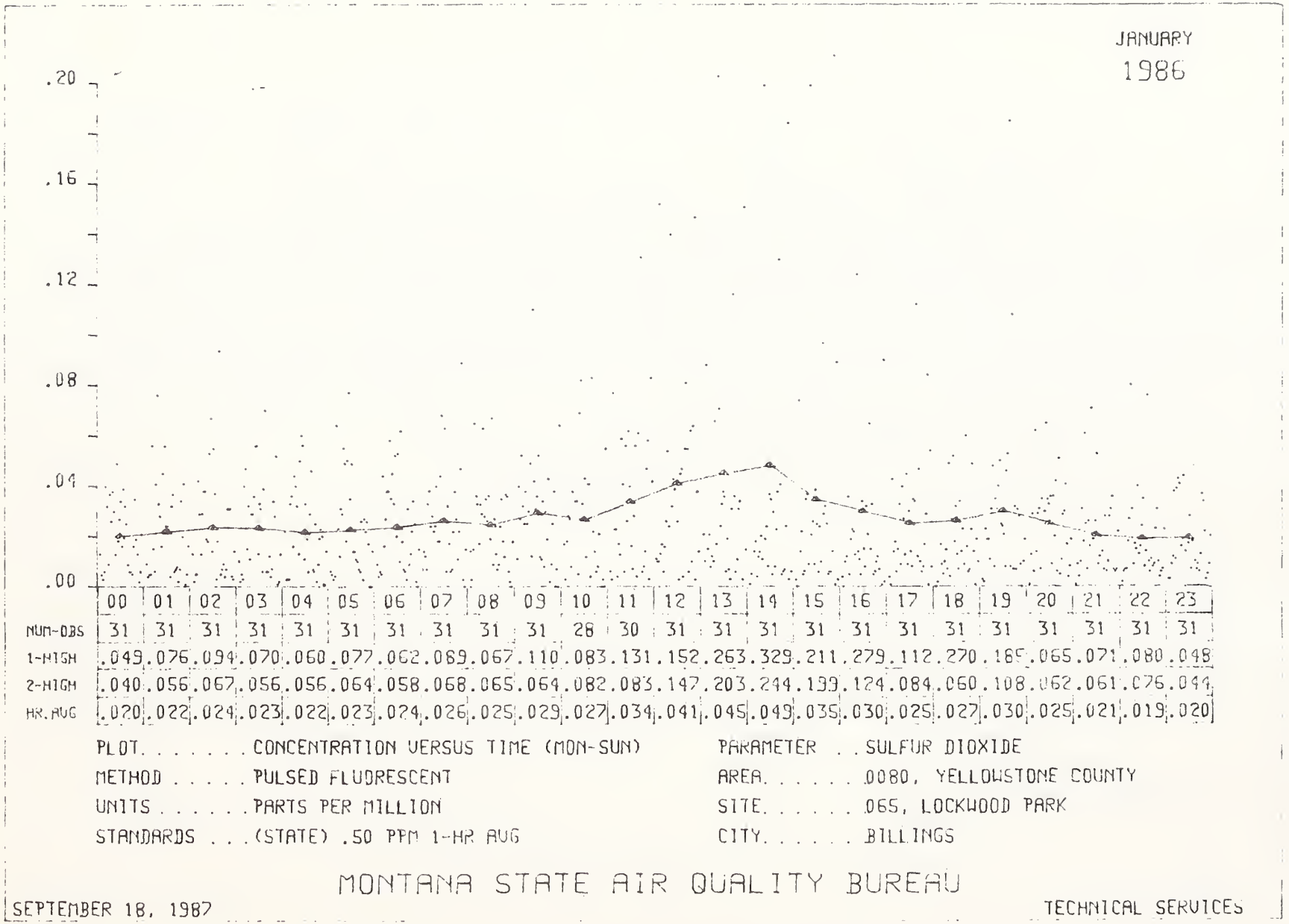
PARAMETER . . CARBON MONOXIDE
AREA. . . . . 0660, CASCADE COUNTY
SITE. . . . . 023, PARDIS CLINIC
CITY. . . . . GREAT FALLS

MONTANA STATE AIR QUALITY BUREAU

SEPTEMBER 17, 1987

TECHNICAL SERVICES

FIGURE AP-11-I



	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
NUM-OBS	31	31	31	31	31	31	31	31	31	31	28	30	31	31	31	31	31	31	31	31	31	31	31	31
1-HIGH	.049	.076	.094	.070	.060	.077	.062	.069	.067	.110	.083	.131	.152	.263	.329	.211	.279	.112	.270	.185	.065	.071	.080	.048
2-HIGH	.040	.056	.067	.056	.056	.064	.058	.068	.065	.064	.082	.083	.147	.203	.244	.139	.124	.084	.060	.108	.062	.061	.076	.044
HR.AVG	.020	.022	.024	.023	.022	.023	.024	.026	.025	.029	.027	.034	.041	.045	.049	.035	.030	.025	.027	.030	.025	.021	.019	.020

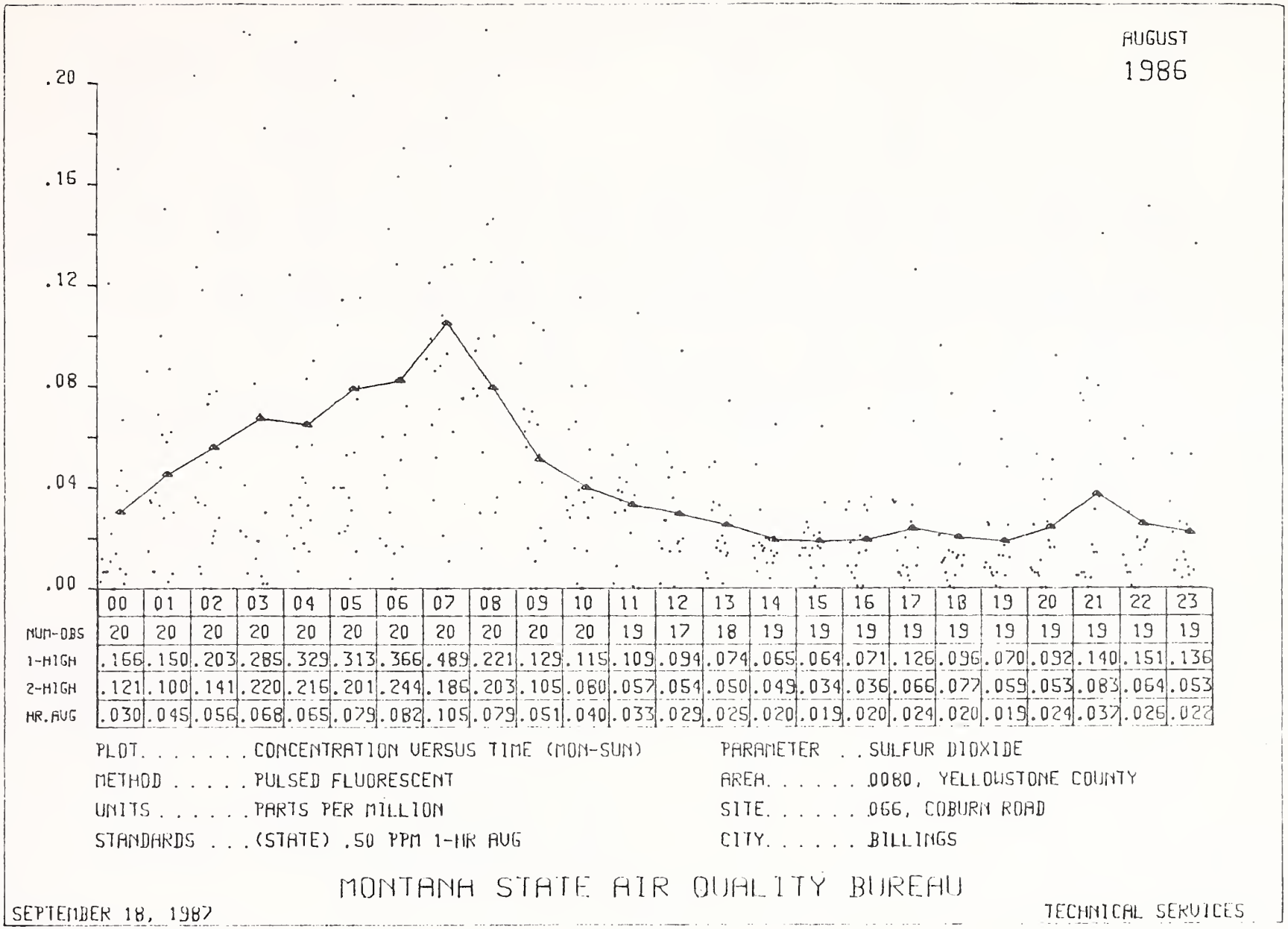
PLOT. . . . . CONCENTRATION VERSUS TIME (MON-SUN)
METHOD . . . . . PULSED FLUORESCENT
UNITS . . . . . PARTS PER MILLION
STANDARDS . . . (STATE) .50 PPM 1-HR AVG

PARAMETER . . SULFUR DIOXIDE
AREA. . . . . 0080, YELLOWSTONE COUNTY
SITE. . . . . 065, LOCKWOOD PARK
CITY. . . . . BILLINGS

MONTANA STATE AIR QUALITY BUREAU

SEPTEMBER 18, 1987 TECHNICAL SERVICES

FIGURE AP-12-I



	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
NUM-OBS	20	20	20	20	20	20	20	20	20	20	20	19	17	18	19	19	19	19	19	19	19	19	19	19
1-HIGH	.166	.150	.203	.285	.329	.313	.366	.489	.221	.129	.115	.109	.094	.074	.065	.064	.071	.126	.096	.070	.092	.140	.151	.136
2-HIGH	.121	.100	.141	.220	.216	.201	.244	.186	.203	.105	.080	.057	.054	.050	.049	.034	.036	.066	.077	.059	.053	.083	.064	.053
HR.AVG	.030	.045	.056	.068	.065	.079	.082	.105	.079	.051	.040	.033	.029	.025	.020	.019	.020	.024	.020	.019	.024	.037	.026	.022

PLOT. . . . . CONCENTRATION VERSUS TIME (MON-SUN)
METHOD . . . . . PULSED FLUORESCENT
UNITS . . . . . PARTS PER MILLION
STANDARDS . . . (STATE) .50 PPM 1-HR AVG

PARAMETER . . SULFUR DIOXIDE
AREA. . . . . 0080, YELLOWSTONE COUNTY
SITE. . . . . 066, COBURN ROAD
CITY. . . . . BILLINGS

MONTANA STATE AIR QUALITY BUREAU

SEPTEMBER 18, 1987 TECHNICAL SERVICES

FIGURE AP-13-I

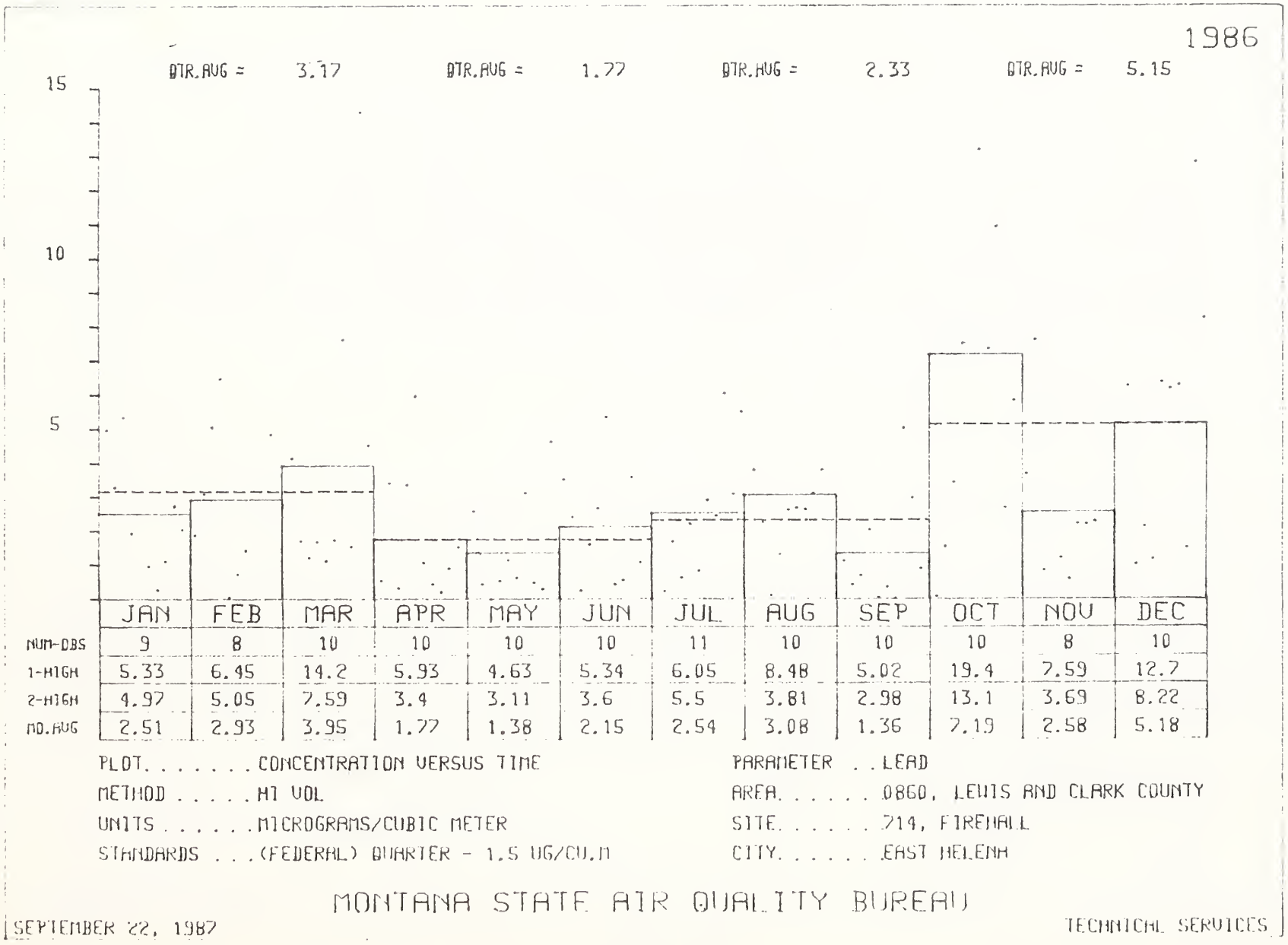
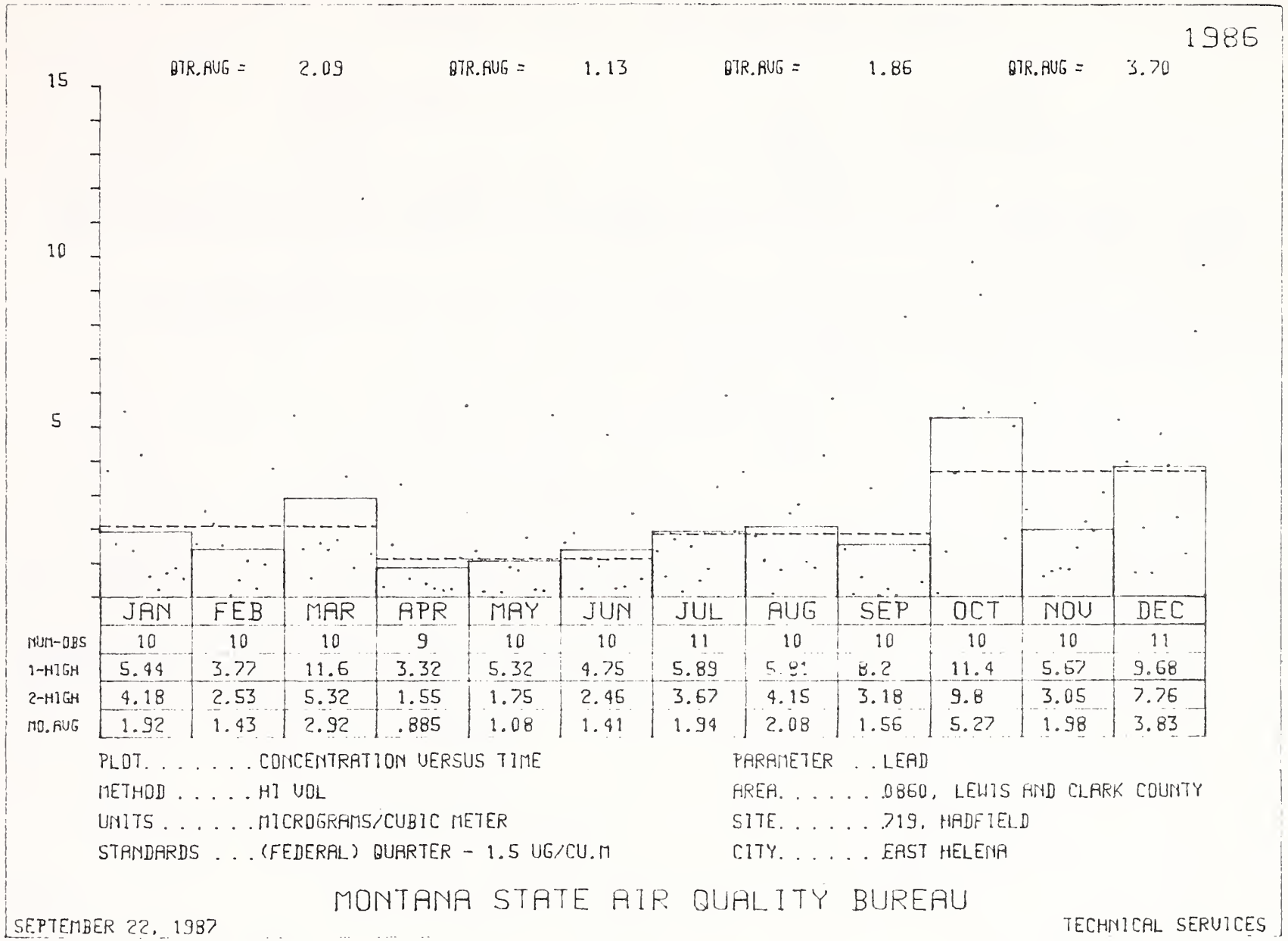

1986
QTR.AVG = 3.17
QTR.AVG = 1.77
QTR.AVG = 2.33
QTR.AVG = 5.15
15
10
5
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
NUM-OBS 9 8 10 10 10 10 11 10 10 10 8 10
1-HIGH 5.33 6.45 14.2 5.93 4.63 5.34 6.05 8.48 5.02 19.4 7.59 12.7
2-HIGH 4.97 5.05 7.59 3.4 3.11 3.6 5.5 3.81 2.98 13.1 3.69 8.22
MD.AVG 2.51 2.93 3.95 1.77 1.38 2.15 2.54 3.08 1.36 7.19 2.58 5.18
PLOT. . . . . CONCENTRATION VERSUS TIME
METHOD . . . . . HI VOL
UNITS . . . . . MICROGRAMS/CUBIC METER
STANDARDS . . . (FEDERAL) QUARTER - 1.5 UG/CU.M
PARAMETER . . LEAD
AREA. . . . . 0860, LEWIS AND CLARK COUNTY
SITE. . . . . 714, FIREHALL
CITY. . . . . EAST HELENA
MONTANA STATE AIR QUALITY BUREAU
SEPTEMBER 22, 1987
TECHNICAL SERVICES

FIGURE AP-14-I



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NUM-OBS	10	10	10	9	10	10	11	10	10	10	10	11
1-HIGH	5.44	3.77	11.6	3.32	5.32	4.75	5.89	5.91	8.2	11.4	5.67	9.68
2-HIGH	4.18	2.53	5.32	1.55	1.75	2.46	3.67	4.15	3.18	9.8	3.05	7.76
MO.AVG	1.92	1.43	2.92	.885	1.08	1.41	1.94	2.08	1.56	5.27	1.98	3.83

PLOT. . . . . CONCENTRATION VERSUS TIME
METHOD . . . . . HI VOL
UNITS . . . . . MICROGRAMS/CUBIC METER
STANDARDS . . . (FEDERAL) QUARTER - 1.5 UG/CU.M

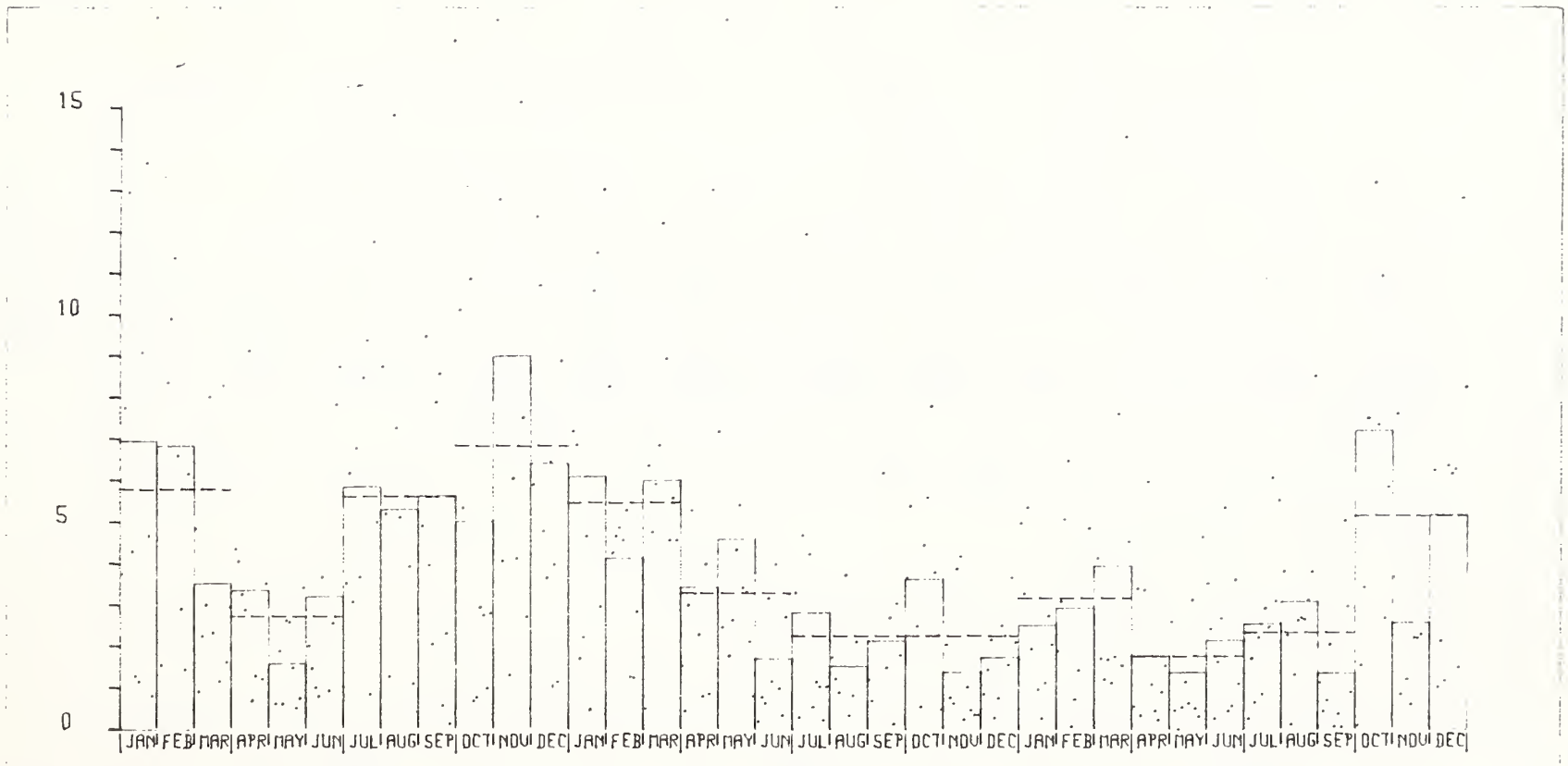
PARAMETER . . LEAD
AREA. . . . . 0860, LEWIS AND CLARK COUNTY
SITE. . . . . 719, HADFIELD
CITY. . . . . EAST HELENA

MONTANA STATE AIR QUALITY BUREAU

SEPTEMBER 22, 1987

TECHNICAL SERVICES

FIGURE AP-15-I


15
10
5
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
1984
1985
1986

NUM OBS	11	9	10	9	9	9	10	9	10	10	10	9	10	9	10	10	11	10	10	7	8	10	10	10	9	8	10	10	10	10	11	10	10	10	8	10
MO.AVG	6.9	6.8	3.5	3.3	1.6	3.2	5.8	5.3	5.6	5.0	8.9	6.4	6.1	4.1	6.0	3.4	4.5	1.7	2.8	1.5	2.1	3.6	1.3	1.7	2.5	2.9	3.9	1.7	1.3	2.1	2.5	3.0	1.3	7.1	2.5	5.1
QTR.AVG	5.77			2.74			5.61			6.82			5.46			3.29			2.25			2.26			3.17			1.77			2.33			5.15		

PLOT. . . . . CONCENTRATION VERSUS TIME
METHOD . . . . . HI VOL
UNITS . . . . . MICROGRAMS/CUBIC METER
STANDARDS . . . (FEDERAL) QUARTER - 1.5 UG/CU.M

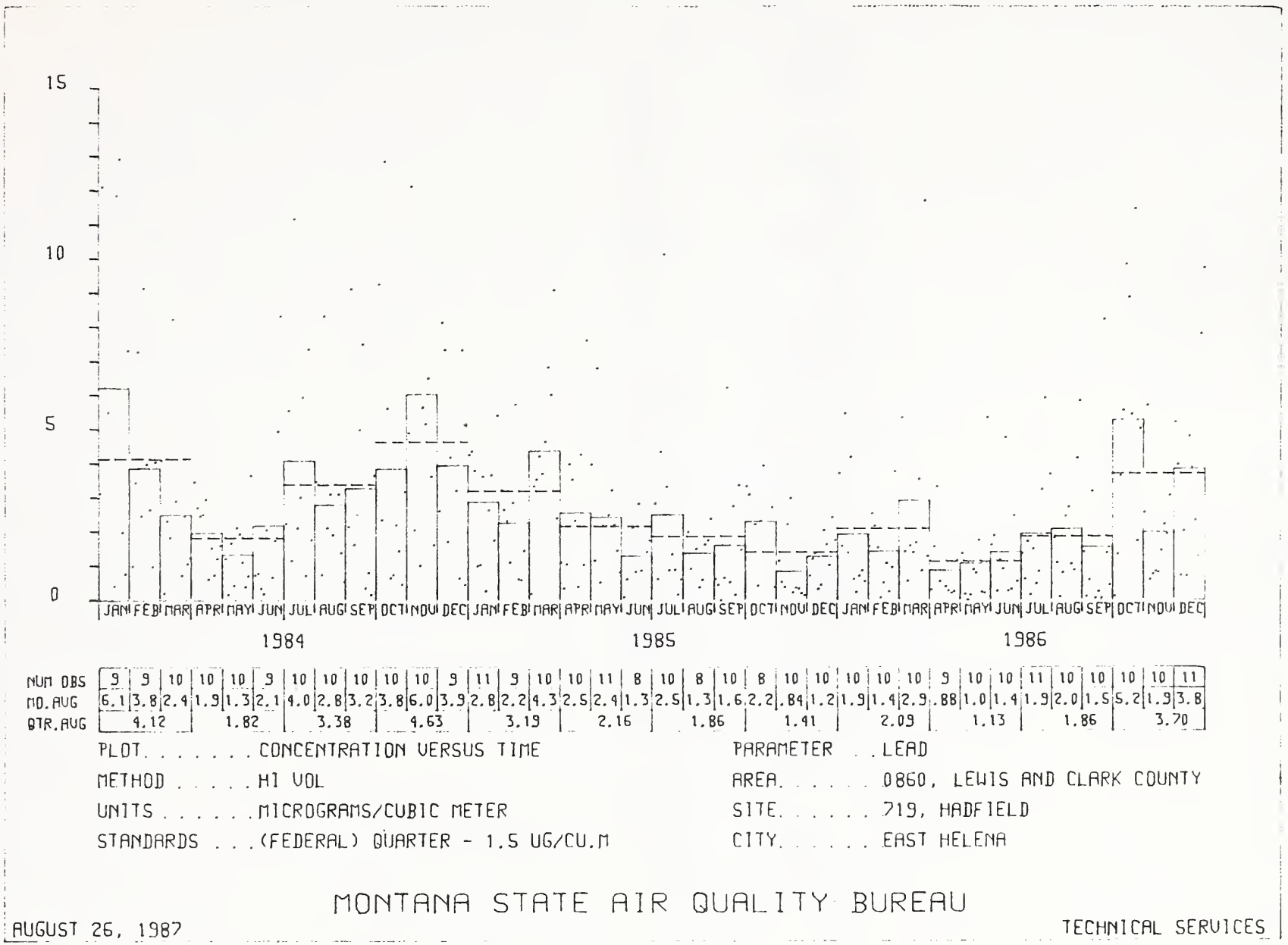
PARAMETER . . LEAD
AREA. . . . . 0860, LEWIS AND CLARK COUNTY
SITE. . . . . 714, FIREHALL
CITY . . . . . EAST HELENA

MONTANA STATE AIR QUALITY BUREAU

AUGUST 26, 1987

TECHNICAL SERVICES

FIGURE AP-16-I


15
10
5
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
1984
1985
1986
NUM OBS 9 9 10 10 10 9 10 10 10 10 10 9 11 9 10 10 11 8 10 8 10 8 10 10 10 10 10 9 10 10 11 10 10 10 10 11
MO.AVG 6.1 3.8 2.4 1.9 1.3 2.1 4.0 2.8 3.2 3.8 6.0 3.9 2.8 2.2 4.3 2.5 2.4 1.3 2.5 1.3 1.6 2.2 .84 1.2 1.9 1.4 2.9 .88 1.0 1.4 1.9 2.0 1.5 5.2 1.9 3.8
QTR.AVG 4.12 1.82 3.38 4.63 3.19 2.16 1.86 1.41 2.09 1.13 1.86 3.70
PLOT . . . . . CONCENTRATION VERSUS TIME
METHOD . . . . . HI VOL
UNITS . . . . . MICROGRAMS/CUBIC METER
STANDARDS . . . (FEDERAL) QUARTER - 1.5 UG/CU.M
PARAMETER . . LEAD
AREA. . . . . 0860, LEWIS AND CLARK COUNTY
SITE. . . . . 719, HADFIELD
CITY. . . . . EAST HELENA
MONTANA STATE AIR QUALITY BUREAU
AUGUST 26, 1987
TECHNICAL SERVICES

APPENDIX J

Smoke Management

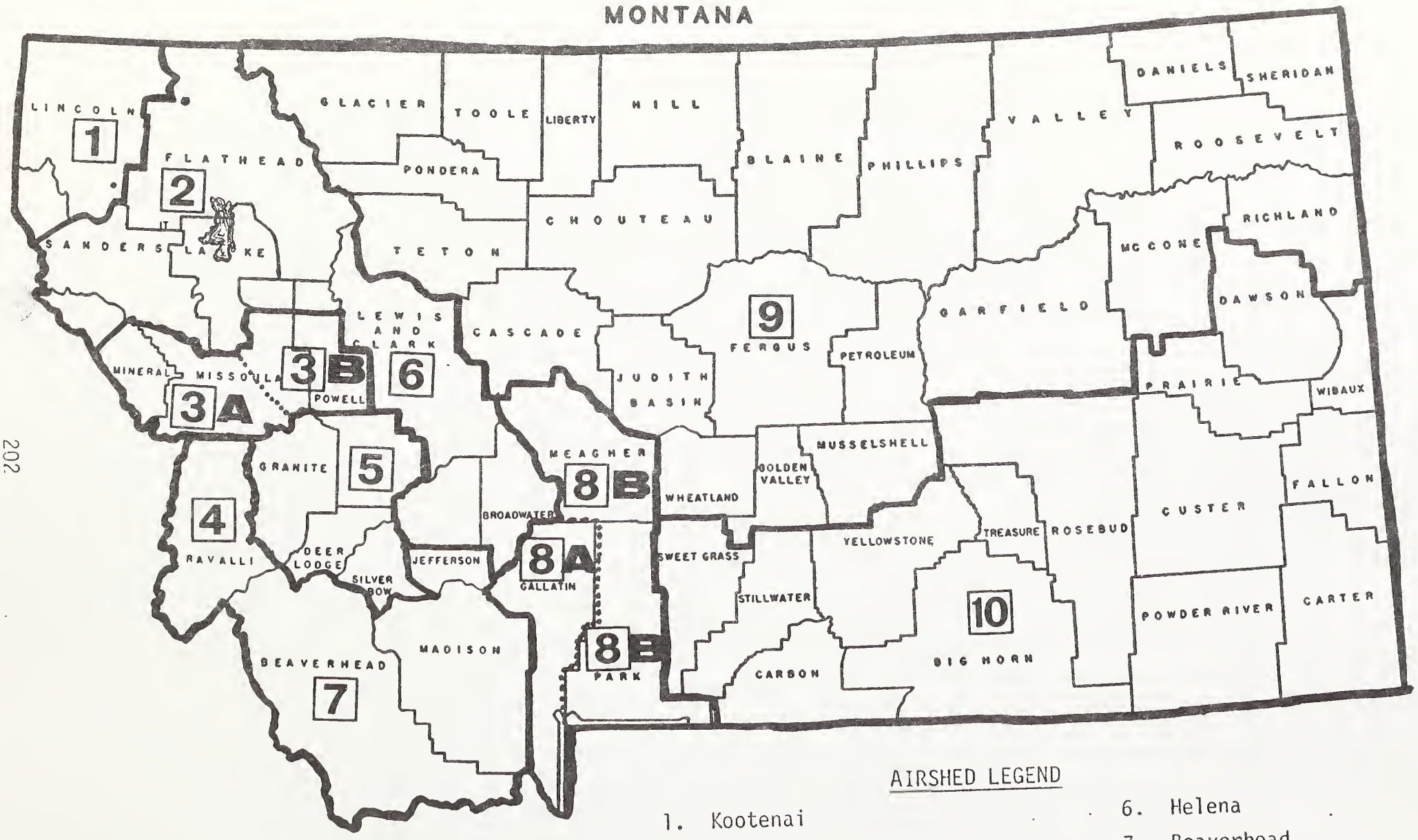
APPENDIX J

SMOKE MANAGEMENT

The Smoke Management Plan was devised by the State Airshed Group to coordinate burning operations on all forest and rangeland in the state. The State Airshed Group consists of representatives from the following agencies and forest products industries:

Air Quality Bureau
U. S. Forest Service
Bureau of Land Management
National Weather Service
Glacier National Park
Yellowstone National Park
U.S. Dept. of Fish & Wildlife
Champion International
Bureau of Indian Affairs
Montana Division of Forestry
Plum Creek Timber Company
Mont. Dept. of Fish, Wildlife & Parks
Missoula City-County Air Pollution Control Board

From September 1 to November 30 each year, a two-person monitoring team is established at the Montana Division of Forestry office in Missoula. This team gathers meteorological information daily and has the authority to issue burning restrictions on days forecast for poor ventilation. Restrictions are issued only for those areas predicted to experience inversions or poor dispersion. Restriction information is available from the U. S. Forest Service Fire Weather network, or by calling the state toll-free number (1-800-225-6779). The map on the following page (Figure AP-1-J) shows the ten designated airsheds in Montana. The success of this plan involves the cooperative effort of all organizations involved in the use of prescribed burning for disposal of slash and other accepted land management practices.



AIRSHED LEGEND

1. Kootenai
2. Flathead
3. Blackfoot-Clark Fork
4. Bitterroot
5. Upper Clark Fork
6. Helena
7. Beaverhead
8. A. Gallatin
   B. Park
9. Missouri
10. Yellowstone

Figure AP-1-J

APPENDIX K

Hi-vol Schedules

APPENDIX K

HI-VOL SCHEDULES

High volume samplers (hi-vols) are usually operated on a one-in-six day schedule. In order to meet the needs of data collectors or hi-vol operators, hi-vol schedules for 1987 and 1988 are presented on the following pages.

Figure AP-1-K

1987

1987 SAMPLING SCHEDULE

(Every Sixth Day)

QUARTER 1

January	February	March
3	2	4
9	8	10
15	14	16
21	20	22
27	26	28

QUARTER 2

April	May	June
3	3	2
9	9	8
15	15	14
21	21	20
27	27	26

QUARTER 3

July	August	September
2	1	6
8	7	12
14	13	18
20	19	24
26	25	30
	31	

QUARTER 4

October	November	December
6	5	5
12	11	11
18	17	17
24	23	23
30	29	29

January
4
10
16
22
28

NOTE: The sampler should start at midnight, run for 24 hours on the date shown, and be stopped at midnight.

Figure AP-2-K

1988

1988 SAMPLING SCHEDULE

(Every Sixth Day)

QUARTER 1

January	February	March
4	3	4
10	9	10
16	15	16
22	21	22
28	27	28

QUARTER 2

April	May	June
3	3	2
9	9	8
15	15	14
21	21	20
27	27	26

QUARTER 3

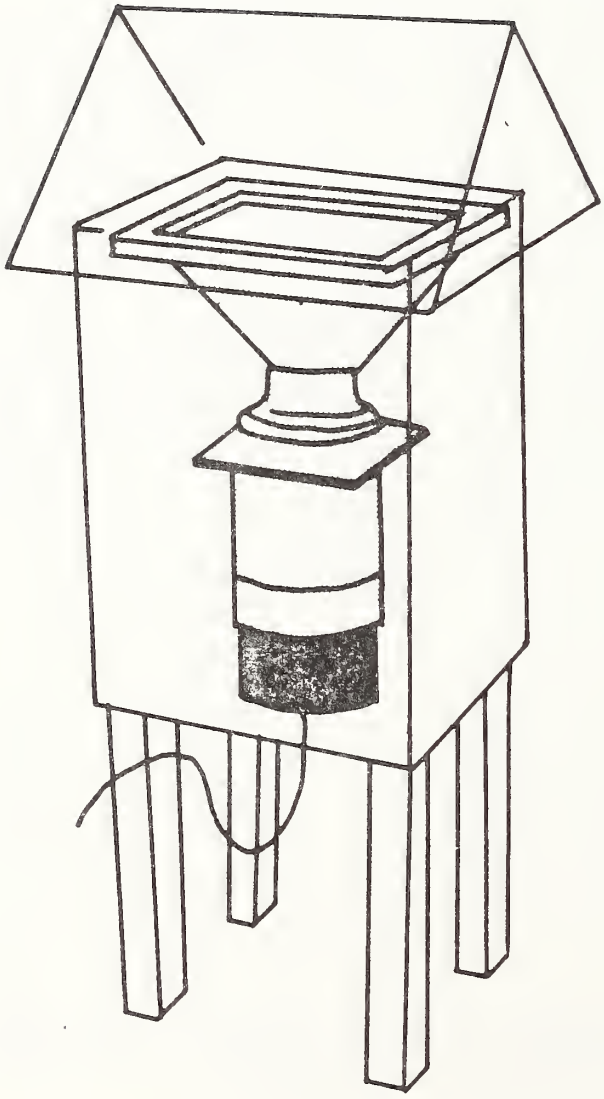
July	August	September
2	1	6
8	7	12
14	13	18
20	19	24
26	25	30
	31	

QUARTER 4

October	November	December
6	5	5
12	11	11
18	17	17
24	23	23
30	29	29

January (1989)
4
10
16
22
28

NOTE: The sampler should start at midnight, run for 24 hours on the date shown, and be stopped at midnight.



APPENDIX L

Visible Emission Documentation

APPENDIX L

VISIBLE EMISSION DOCUMENTATION

Visible emission documentation on a pollution source is performed by a trained observer in the field. A pollution source may be a teepee burner, asphalt plant, boiler, power plant or any stack or emission point that might exhibit a plume.

Visible emission readings are taken by the observer in five percent increments of opacity. Opacity is defined as the degree, expressed in percent, to which emissions reduce the transmission of light and obscure the view of an object in the background.

All point sources have opacity limitations. These are listed in the air quality rules. The opacity standards range from 10 to 40 percent and depend on the type and age of the source.

In order for a person to become a trained observer, he or she must attend a visible emissions documentation course or "smoke school." The Air Quality Bureau offers a smoke school twice each year, usually in April and October. The observer must attend a lecture session and pass a field session in order to pass smoke school.

The lecture section includes the following topics:

Definition of opacity

Composition of Plumes

Meteorological aspect of Plumes

Smoke Generator

Method 9 Certification Procedures and Field Documentation

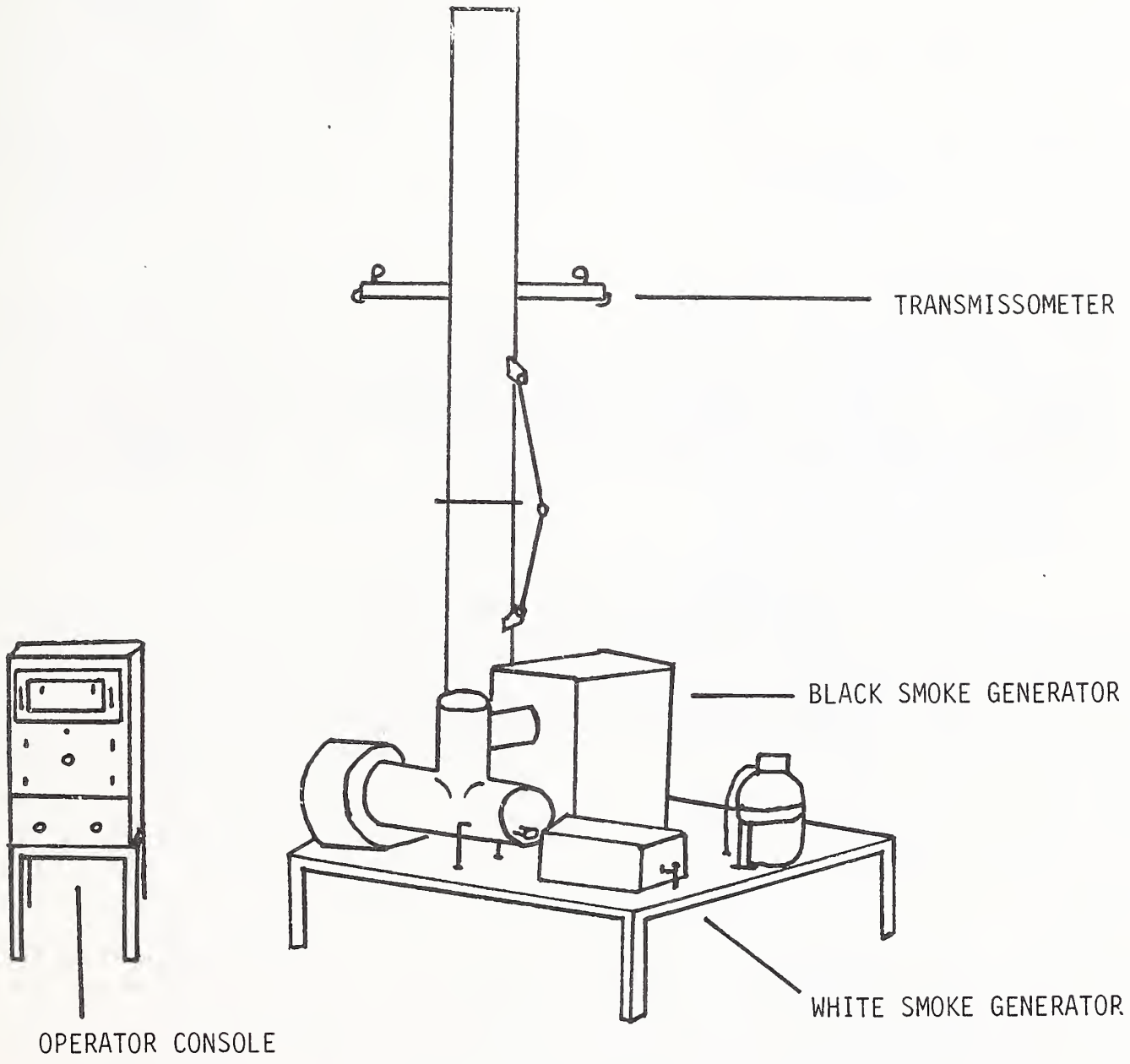
Opacity Regulations

Legal Aspects of Opacity

During the field portion, the observer reads the opacity of 25 black and 25 white smoke plumes produced by a smoke generator. Observed opacities are compared with measured opacities (transmissometer readings) and a certain degree of accuracy is needed to pass.

After a person passes smoke school, that observer is qualified to read the opacity of a plume in the field. A plume must be read every 15 seconds for six minutes, for a total of 24 readings. An average of the 24 readings gives the percent opacity. Care must be taken not to read a steam plume if one exists.

A drawing of the smoke generator (Figure AP-1-L) and a visible emission documentation form (Figure AP-2-L) are copied on the following pages.



ENVIRONMENTAL INDUSTRIES

MODEL 3000

SMOKE GENERATOR

Figure AP-1-L

MONTANA STATE DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY BUREAU

VISIBLE EMISSIONS FIELD DOCUMENTATION

FIRM NAME _____ DATE _____
ADDRESS _____ START TIME _____
BUSINESS _____ STOP TIME _____
DESCRIPTION OF SOURCE _____ OBSERVER _____
_____ OBSERVATION POINT _____
TYPE OF FUEL _____ _____
STACK HEIGHT _____ STACK DIAMETER _____ _____
DISTANCE FROM STACK _____ ☐ RESPONSE TO COMPLAINT
DIRECTION FROM STACK _____ ☐ ROUTINE INSPECTION
GENERAL PLUME CHARACTERISTICS (COLOR, ETC.) ☐ OBSERVATION
_____ ☐ SPECIAL INVESTIGATION
GENERAL METEOROLOGY: SKY CONDITIONS AND COLOR _____ EST. AMBIENT
AIR TEMP. _____ EST. WIND SPEED _____ DIRECTION _____ EST. RELATIVE HUMIDITY _____

PLUME DENSITY READINGS: IN OPACITY

MIN / SEC	0	15	30	45	REMARKS
0					
1					
2					
3					
4					
5					

MIN / SEC	0	15	30	45	REMARKS
0					
1					
2					
3					
4					
5					

0					
1					
2					
3					
4					
5					

0					
1					
2					
3					
4					
5					

0					
1					
2					
3					
4					
5					

0					
1					
2					
3					
4					
5					

OTHER REMARKS _____

AVERAGE PLUME DENSITY OPACITY _____ TOTAL MINUTES IN VIOLATION _____

IF VIOLATION NOTED, PERSON CONTACTED _____ DATE _____ TIME _____

Figure AP-2-L

VISIBLE EMISSION DOCUMENTATION FORM

APPENDIX M

Air Quality Personnel

APPENDIX M

AIR QUALITY PERSONNEL
1986

Air Quality Bureau

(406) 444-3454
(406) 657-2617 (Billings)

Jeffrey T. Chaffee, Chief
*Harold Robbins, Chief
*Dean Arthun (Billings)
John Coefield
Patricia Davidson
Pat Driscoll
Jan Gilman
Kay Hansen
Charles Homer
Jim Hughes (Billings)
Shirley Quick Jasper
Bob Jeffrey
Harry Keltz
*Jackley Meyers
Warren Norton
Jim Olsen
Jerry Preszler
Bob Raisch
Jerry Schneider
Stan Sternberg
Cindy Whitaker

Cascade County Air Pollution Control

(406) 761-1190

William Neilsen
Bruce Treis

Lewis and Clark County

(406) 443-1010

Joan Miles
Penny Weis

Missoula City-County Health Department

(406) 721-5700

Linda Hedstrom
Jim Carlson
Scott Church
Adam Rys-Sikora

*No longer employed by the Air Quality Bureau.

Yellowstone County Air Pollution Control

(406) 252-0756

Steve Duganz
Russ Boschee

Air Quality Bureau

Existing Organization
Nov. 1986

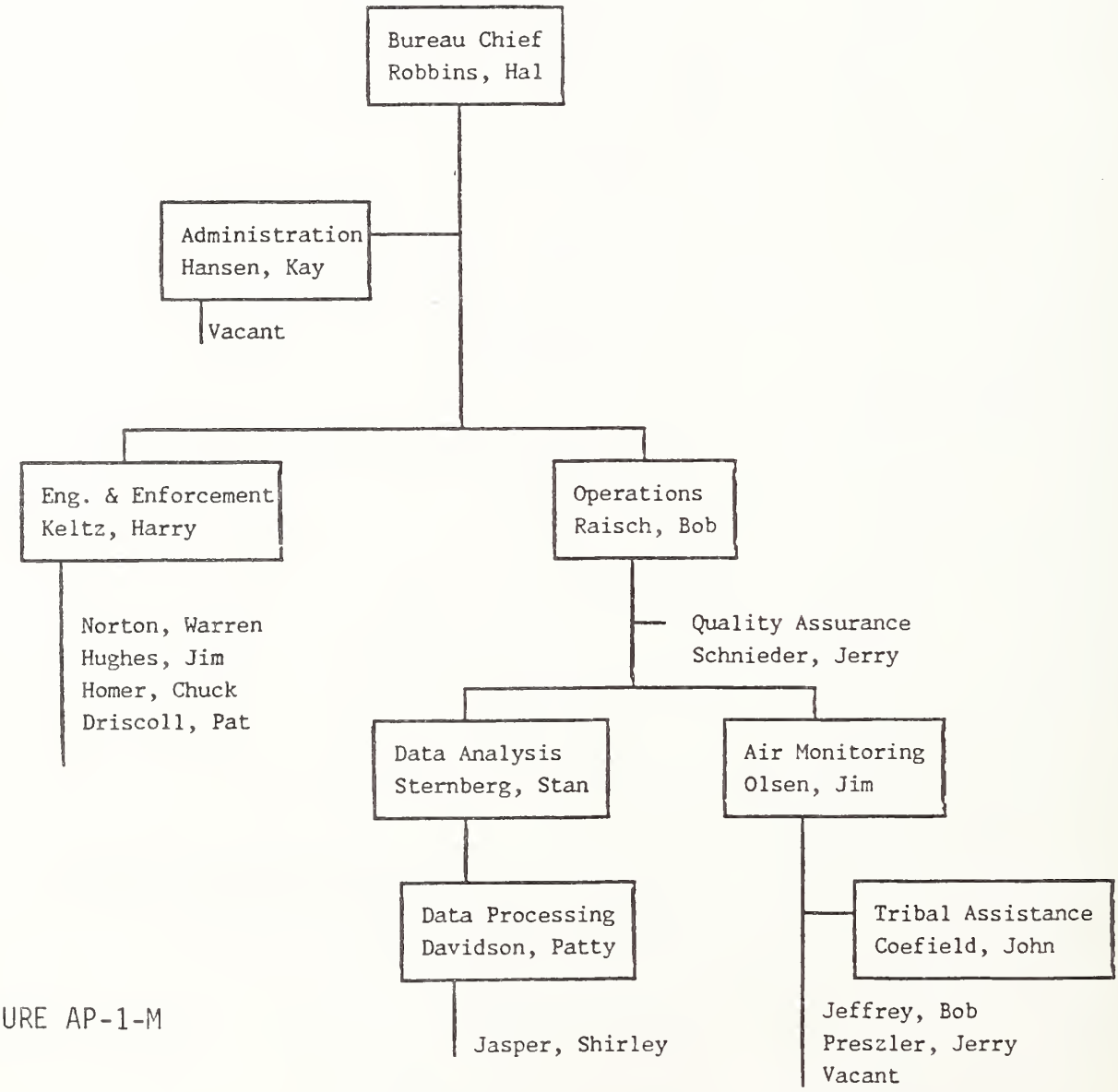


FIGURE AP-1-M

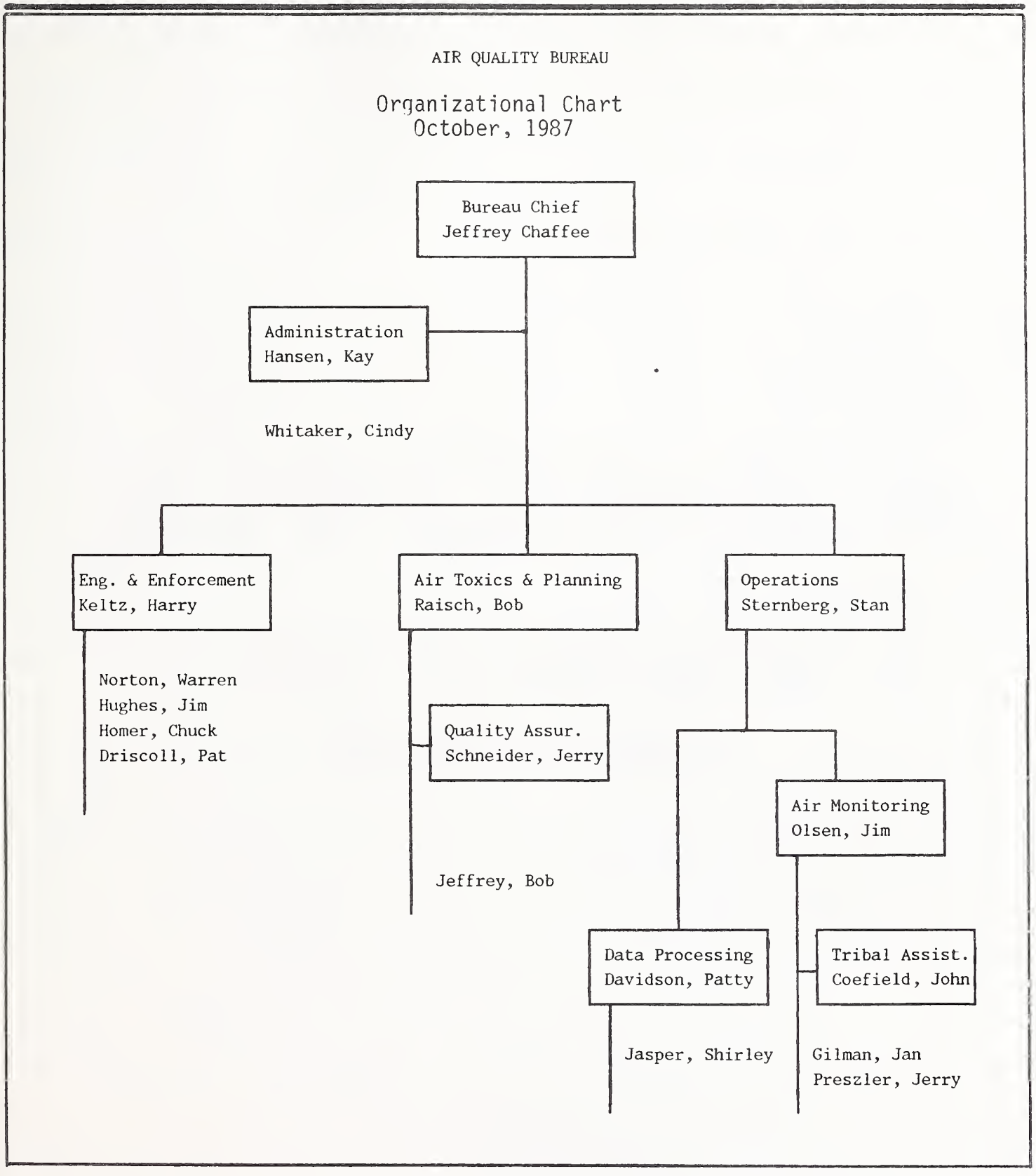

AIR QUALITY BUREAU
Organizational Chart
October, 1987
Bureau Chief
Jeffrey Chaffee
Administration
Hansen, Kay
Whitaker, Cindy
Eng. & Enforcement
Keltz, Harry
Norton, Warren
Hughes, Jim
Homer, Chuck
Driscoll, Pat
Air Toxics & Planning
Raisch, Bob
Quality Assur.
Schneider, Jerry
Jeffrey, Bob
Operations
Sternberg, Stan
Air Monitoring
Olsen, Jim
Data Processing
Davidson, Patty
Jasper, Shirley
Tribal Assist.
Coefield, John
Gilman, Jan
Preszler, Jerry

FIGURE AP-2-M

AIR QUALITY BUREAU

Section Responsibilities
7/22/87

Administration Section

A. Budgeting
B. Planning
C. Office Management

Engineering and Enforcement Section

A. Permit Review
B. Inspections
C. Enforcement
D. Smoke Management
E. Open Burning
F. NESHAPS
G. Emission Inventory

Operations Section

A. Air Monitoring
B. Equipment Repair
C. Dispersion Modeling
D. Data Processing
E. Computer Programming
F. Annual Report and Network Review

Air Toxics and Planning Section

A. Air Toxics Emission Inventory
B. Toxic Risk Assessment
C. Air Toxics Program Development
D. Quality Assurance
E. State Implementation Plans

APPENDIX N

Air Monitoring Equipment

APPENDIX N

Air Monitoring Equipment

This appendix is intended to give the data and information user a brief description of how air monitoring equipment works. Most of the information contained in this appendix was taken from the Air Quality Bureau's Quality Assurance Handbook.

Table AP-N-I gives a summary of the various pollutants and their analytical procedure.

Table AP-N-I
Pollutants and Analytical Procedures

Analyte	Procedure
Total Suspended Particulate	Filter Impaction/Gravimetric Analysis
Particulates	Beta Attenuation
Respirable Particulates (PM10)	Size Selective Hi-vol/Gravimetric Analysis
Respirable Particulates	Dichotomous Virtual Impactor/ Gravimetric Analysis
Lead	Filter Impaction/Atomic Absorption Spectrophotometry/ICAP
Carbon Monoxide	Non-dispersive Infrared
Sulfur Dioxide	Pulsed Fluorescence
Hydrogen Sulfide and Sulfur Dioxide	Gas Chromatography and Flame Photometric Detection
Nitrogen Oxides	Chemiluminescence
Ozone	Ultraviolet Photometry
Fluoride	Dual Tape Sampler
Gaseous and Particulate Fluorides	Bicarbonate Tube
Foliar Fluoride	Colorimetric Method
Visibility	Integrating Nephelometer
Metals	ICP or ICAP

Analyte: Total Suspended Particulates (TSP)

Procedure: Filter impaction/gravimetric analysis

General Information:

Particulate matter is collected by a high volume sampler (hi-vol) by pulling a known volume of air through a preweighed glass fiber filter. As the air is pulled through the filter, particulate matter that is suspended in the air is impacted onto the filter material. After the sampler has run for 24 hours, the filter is reweighed. The weight of the particulate matter (grams) on the filter is divided by the volume of air [cubic meters (m^3)] to give a concentration in micrograms per cubic meter ($\mu g/m^3$).

The hi-vol is constructed of aluminum in the shape of a box (dimensions 16" x 16" x 48") with a pitched roof. The interior contains a "vacuum cleaner" type electric motor, a filter holder, a flow measuring device(s), and a timer. The samplers usually run on a one-in-six day schedule but may be run more frequently if necessary.

The filters are weighed on a laboratory balance in a temperature and humidity controlled room. The balance must be accurate to one tenth of a milligram (0.1 mg) or one ten thousandth of a gram. The filters are dessicated for twenty-four hours prior to weighing.

Analyte: Particulates

Procedures: Beta attenuation

General Information:

This analyzer measures concentrations of airborne particulates, integrated over preprogrammed time intervals, by the process of beta ray attenuation. Samples are collected on strips of glass fiber tape. Before the sample is collected, the tape is positioned between a beta ray source (C14) and a geiger counter. The beta ray count taken through the tape is used as a blank value. Sample is deposited on the tape by a constant flow of ambient air. The sample and tape are again situated between the source and counter. This second count will be lower than the first count because the sample will absorb some of the beta rays in excess to the amount of X-rays absorbed by the tape itself. The difference in beta ray counts between the tape and the tape plus sample is log proportional to the amount of sample on the tape. After calculating the sample mass, it is divided by the total airflow over the sample collection period. This gives an integrated particulate concentration for that sample period. All calculations are done internally by the analyzer with a microprocessor. Sample times as low as 3 minutes or as great as 999 minutes can be programmed by the user.

Analyte: Respirable Particulates (PM10)

Procedure: Size Selective Hi-vol/Gravimetric Analysis

General Information:

The PM10 size selective high volume air sampler operates at a high flow rate of 40 cfm and is the same as a TSP hi-vol, but samples suspended particles smaller than 10 microns on an 8" x 10" hi-vol filter.

Suspended particles in the air are sampled at 40 cfm through the circumferential inlet of the size selective inlet. The symmetrical design insures wind direction insensitivity. The inlet design and the internal configuration make the collection efficiency dependent of wind speed from 0 to 24 kilometers per hour. Air is drawn into the inlet and deflected downward into the acceleration jets of the first stage fractionator. By virtue of their larger momentum, particles greater than the 10 micron cutpoint impact onto the first stage collection plate. The remaining particles are carried vertically upward by the air flow and then down through the second fractionation stage which strips additional 10 micron and larger particles. All remaining particles are drawn out of the inlet and through the 8" x 10" sampling filter. Just as in standard hi-vol TSP sampling, the filter is weighed before and after sampling. The weight increase is the mass of particles smaller than 10 microns. The air volume is properly totalized by maintaining constant flow rate with a flow controller.

Analyte: Respirable and Inhalable Particulates

Procedure: Dichotomous or Virtual Impactor

General Information:

The dichotomous sampler is designed to sample for particulates of two size ranges: 1) those particles less than 3.5 microns (aerodynamic diameter), and 2) those particles greater than 3.5 microns and less than 15 microns. Two 37 millimeter diameter filters collect the particulate, one filter for each size range. The filters are weighed before and after each run to determine the mass loading on each filter. Concentration is then calculated by dividing the net weight by the air flow through each filter. Two rotometers are installed on the sampler to measure the flow during the run.

This type of instrument is divided into two sections: the sampling module and the control module. The sampling module contains the sampling head separation device and the two filters. The control module contains the air pump, flow controller, rotameters and the clock mechanism. The two units are connected by polypropylene tubing.

The sampling module is the portion where the actual separation and collection of each particle size is accomplished. The particles larger than 15 microns are eliminated at the round sampling head. A bug screen is placed in the sampling head to keep out insects and to collect particles larger than 15 microns. The particles less than 15 microns proceed down the sampling tube to the nozzle. The nozzle accelerates the particles and forces the majority of air (approximately 90%) to make a sharp 90° turn in a very short distance. This 90° turn is the principle on which the separation is based. Any heavy particle (i.e., any particle greater than 3.5 microns) will not be able to make this sudden turn. These particles will be drawn down into the coarse particles tube which is located straight below the nozzle. The other particles (less than 3.5 microns) will make the 90° turn and will be drawn down the fine particle tube. At the bottom of both tubes are the appropriate filters. The air flow is drawn from the control module through the 3/8" and 1/4" lines.

The filters are weighed on a microbalance in a temperature and humidity controlled room. The balance must be accurate to one millionth of a gram (0.000001 gm). The filters are dessicated for twenty-four hours prior to weighing.

Analyte: Lead

Procedure: Atomic Absorption Spectrophotometry

General Information:

Lead is sampled in the field using a standard high volume air sampler. This sampler pulls a large volume of air through a glass fiber filter. The filter is then normally mailed from the field site to the Air Quality Bureau where the sample is logged in. The volume of the air sample is calculated and then it is transferred to the laboratory for analysis. The filter is equilibrated and weighed for total suspended particulate. Then the filter must be extracted using an acidic solution to solubilize the lead on the filter. The resulting solution is analyzed using atomic absorption spectrophotometry or ICAP to determine the amount of lead present.

Analyte: Carbon Monoxide

Procedures: Non-dispersive Infrared

General Information:

The (carbon monoxide) analyzer measures continuous amounts of carbon monoxide from 0-50 to 0-1000 ppm full scale deflection. The detector operates on an infrared absorption principle.

The analyzer detects carbon monoxide from the absorption of infrared radiation. Non-dispersive infrared radiation is introduced to the detector with a double-beam arrangement. The infrared beams pass through two cells: 1) a sealed reference cell filled with a non-absorbing gas, and 2) a sample cell through which the sample air containing the carbon monoxide is continuously drawn.

The infrared gas analyzer utilizes the measurement principle based on CO having a known characteristic absorption spectra in the infrared range. The analyzer contains an infrared detector that uses the non-dispersive single beam technique with alternate modulation of the sample and reference cells. The reference cell is filled with a non-absorbing gas and sealed, and the sample is routed through the sample cell. With no CO present in the sample, the amounts of radiation coupled into the detector from the sample and reference cells will be essentially equal, effectively cancelling in the detector and producing no output. When CO is present in the sample, some radiation is absorbed by the CO, causing the detector inputs to be unequal, and producing a capacitance change in the detector. The detector is so designed that the amount of capacitance change in the detector is equivalent to a known amount of CO. The infrared radiation is chopped by an optical chopper to cause a periodic capacitance change, which modulates a radio frequency signal from an oscillator. This signal is subsequently demodulated, amplified, and the output is fed to the front panel meter as well as to a strip chart recorder.

Analyte: Sulfur Dioxide

Procedures: Pulsed Fluorescence

General Information:

The sample airstream is exposed to a pulsating ultraviolet light, which electromagnetically excites sulfur dioxide molecules in the air sample. The excited SO_2 molecule quickly decays to its ground state emitting a photon of fluorescent light, whose intensity is measured by a photomultiplier tube. The wavelength of excitation light entering the detection chamber and the wavelength of fluorescent light entering the photomultiplier tube both are carefully controlled by narrow bandpass filters, which reduce interference from other fluorescent species in the sample gas. The light is pulsed for six reasons: long UV lamp life, high intensity UV without lamp heating, small lamp size for UV output, low lamp power requirements, long-term UV stability, and chopped signal processing (alternatively measuring signal and photomultiplier dark current). After the photomultiplier dark current is subtracted from the fluorescent SO_2 signal, the signal output is directly proportional to the concentration of SO_2 in the sample gas.

Analyte: Hydrogen Sulfide and Sulfur Dioxide

Procedures: Gas Chromatography and Flame Photometric Detection

General Information:

Ambient air entering the analyzer is separated into two fragments by a gas chromatographic column, one part containing any sulfur dioxide present in the sample and the second component consisting of any hydrogen sulfide. The amount of sulfur atoms in each fragment is detected by a flame photometer. This detection principle consists of burning the sample in a hydrogen rich flame, which produces the excited reduced species S_2. The S_2 decays to ground state emitting a photo near 390nm. This photon is sensed by a photomultiplier tube. Because the measured molecule is a sulfur dimer, the photomultiplier output (picoamps) is nonlinear with respect to ambient sulfur concentrations. The output is approximately to the 1.8 power of the ambient concentration. Deviation from the theoretical second power is due to quenching of the excited species. The photomultiplier output is linearized by a set of logarithmic amplifiers. The rest of the analyzer consists of flow control devices and temperature controllers for the detector oven and column.

Analyte: Nitrogen Oxides

Procedures: Chemiluminescent Reaction of NO and O_3

General Information:

The analyzer utilizes a chemiluminescent reaction between nitric oxide and ozone to quantitatively determine the concentration of nitrogen oxides in the sample air. Ozone, produced in excess by ultraviolet irradiation of dried air, is reacted with any nitric oxide in the sample air and the resultant chemiluminescent photons are measured with a photomultiplier proportional to the amount of nitric oxide in the sample. A second portion of sample air is routed through a converter which changes all the NO_2 in the sample air to nitric oxide. This gas is reacted in another reaction chamber with the ozone and gives a measurement proportional to the total amount of nitrogen oxides in the sample. Thus, there are two parallel reaction chambers determining the nitric oxide concentration and the total nitrogen oxides concentration. These signals are electronically subtracted to give a nitrogen dioxide concentration.

Analyte: Ozone

Procedure: Ultraviolet Photometry

General Information:

This analyzer works on the principle of absorption of ultraviolet light in the 254nm band by ozone. The principle is similar to an ultraviolet spectrophotometer with a 71cm folded gas cell. A sample of ambient air, selectively scrubbed of ozone, is injected into the cell. The attenuation of ultraviolet light without ozone is determined by a light sensitive diode. The sample cell is flushed and a new sample of air containing ambient levels of ozone is measured for ultraviolet absorption. The sample air without ozone is a reference cell measurement. The difference between the reference measurement and the sample with ozone measurement determines the ultraviolet absorption attributable only to the ozone. This absorption is proportional to the ozone concentration by the Beer-Lambert laws. Since only a single detection cell is used in the instrument, ambient air and ozone-scrubbed ambient air are sequentially cycled through the cell. This cycle time is between 20 and 30 seconds. This means that the anlayzer will not give correct values in situations in which the ozone concentration changes significantly in 30 seconds. This usually does not present a problem in enforcement monitoring but may be significant in low level research near point sources.

Analyte: Fluoride

Procedures: Dual Paper Tape Collection of HF and Particulates

General Information:

Sample air is drawn through the inlet tube and down through two paper tapes. The first tape is treated with citric acid and functions as a collector for particulates. The citric acid prevents the first tape from reacting with and absorbing gaseous hydrogen fluoride. The second tape is treated with sodium hydroxide and recovers better than 95 percent of the hydrogen fluoride at sampling times of 15 to 120 minutes with fluoride loads up to 40 $\mu g/m^3$. The sample air is drawn through a soda lime scrubber which removes the fluorides. The scrubbed air is used to pressurize the cabinet containing the sample tape rolls, thus preventing unwanted fluoride contamination of the tape by the intrument's operating environment. At preprogrammed time intervals the sampler shuts off the sample pump, indexes the tape and then samples a new section of tape. Approximately 600 samples can be collected on each tape set. The sample spots are cut out of the tape and subjected to one of the standard acceptable methods of fluoride analysis.

Analyte: Gaseous and Particulate Fluorides

Procedure: Bicarbonate Tube

General Information:

Sample air is drawn through a glass tube which has sodium bicarbonate coated on the inner wall of the tube. The bicarbonate removes gaseous fluorides from the sample stream. A filter at the end of the tube captures the particulates from the sample. After the normal sampling interval (usually 24 hours), the sample flow is stopped. The filter is retained for analysis of particulate fluorides. The bicarbonate is washed out of the tube and analyzed for fluoride content. Recovery of gaseous HF is about 95% up until saturation of the tube at 500 µg F. Sample air which is high in acids (SO_2, NO_2, O_3 and hydrocarbons, at 50% or greater relative humidity) will react with the bicarbonate in the tube and reduce collection efficiency and total fluoride holding capacity. The lower detectable limit of the method is a function of the quality of the bicarbonate used for coating the tubes. Bicarbonate containing significant fluoride contamination will not have the low level resolution of fluoride free bicarbonate. The minimum detectable limit is determined as two standard deviations of the mean of the blank values. The blanks come from sample tubes which have been prepared for sampling but are maintained unexposed.

Analyte: Foliar Fluorides

Procedure: Colorimetric Method

General Information:

Forage samples are collected from pre-selected areas twice per month. Such areas must be growing hay or silage or being grazed by livestock when the samples are collected. Each sample consists of a composite of at least 25 clippings collected in a predetermined geometric pattern over the area. The entire aerial portion of the plant over 3 cm above the ground is collected.

The samples are collected and stored in Kraft bags under carefully regulated temperatures awaiting laboratory analysis. In the laboratory the samples are air dried at 80° C for 24-48 hours. The samples are then milled to pass a 40 mesh sieve. The milled samples are dissolved in solution, distilled, buffered and analyzed with a colorimeter or by the specific ion electrode procedure.

Analyte: Visibility

Procedure: Integrating Nephelometer

General Information:

The visibility is determined by the measurement of the atmospheric extinction coefficient due to light scattering by both gases and aerosols in the air. The quantitative output can be displayed in units of scattering coefficient, meteorological range, or mass concentration of particulates. The air is drawn into a one-meter long tube where light is flashed across the air stream at right angles to the photodetector. Any light scattered due to particulates will be detected and recorded on a strip chart recorder.

Analyte: Metals

Procedure: ICP or ICAP

General Information:

Samples are nebulized and the aerosol that is produced is transported to the plasma torch where excitation occurs. Characteristic atomic-line emission spectra are produced by a radio-frequency inductively coupled plasma (ICP). The spectra are dispersed by a grating spectrometer and the intensities of the lines are monitored by photomultiplier tubes. The photocurrents from the photomultiplier tubes are processed and controlled by a computer system. A background correction technique is required to compensate for variable background contribution to the determination of trace elements. Background must be measured adjacent to analyte lines on samples during analysis. The position selected for the background intensity measurement, on either or both sides of the analytical line, will be determined by the complexity of the spectrum adjacent to the analyte line. The position used must be free of spectral interference and reflect the same change in background intensity as occurs at the analyte wavelength measured. Background correction is not required in cases of line broadening where a background correction measurement would actually degrade the analytical result.

CONVERSION FACTORS

SO_2 1 PPM = 2,620 UG/M^3

H_2S 1 PPM = 1,400 UG/M^3

NO_2 1 PPM = 1,330 UG/M^3

NO 1 PPM = 1,227 UG/M^3

O_3 1 PPM = 1,960 UG/M^3

CO 1 PPM = 1,150 UG/M^3

APPENDIX O

Air Quality Data Processing Information

APPENDIX O

AIR QUALITY DATA PROCESSING INFORMATION

Agencies and companies often need to submit their air monitoring data to the state's computer system (AQDHS). This appendix is a brief summary of the various data forms and magnetic tape requirements for submitting data.

Figures AP-1-O through AP-4-O show four keypunch forms used for hourly, daily, and monthly data. Forms 2179 and BAC are used for daily (24-hour) data while form BAQ is generally used for monthly data. The SAROAD form is used only for hourly data. Brief instructions for forms 2179 and SAROAD follow the figures. Some parameter codes are listed.

Agencies and companies may submit their data on magnetic tapes. The data must be of the same format as the before-mentioned keypunch forms. Tape requirements are as follows:

Standard IBM label (if labeled)

Prefer Non-labeled (NL)

9-track tape

800, 1600, 6250 BPI's (specified)

80 characters

Any blocking size (specified)

EBCDIC

SAROAD on one file only

BAC, BAQ, 2179 one file only

Data may also be submitted on floppy diskettes, $5\frac{1}{4}$" or $3\frac{1}{2}$". The diskettes must be IBM-PC compatible and in the required SAROAD format.

STATE OF MONTANA
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY BUREAU

Date Received: _____

Analyst: _____

Date Completed: _____

	2	7
1	2	3

HV Mem. Dichot.

Parameter	Parameter	Parameter	Parameter
23 24 25 26 27	37 38 39 40 41	51 52 53 54 55	65 66 67 68 69

Method Units DP	Method Units DP	Method Units DP	Method Units DP
28 29 30 31 32	42 43 44 45 46	56 57 58 59 60	70 71 72 73 74

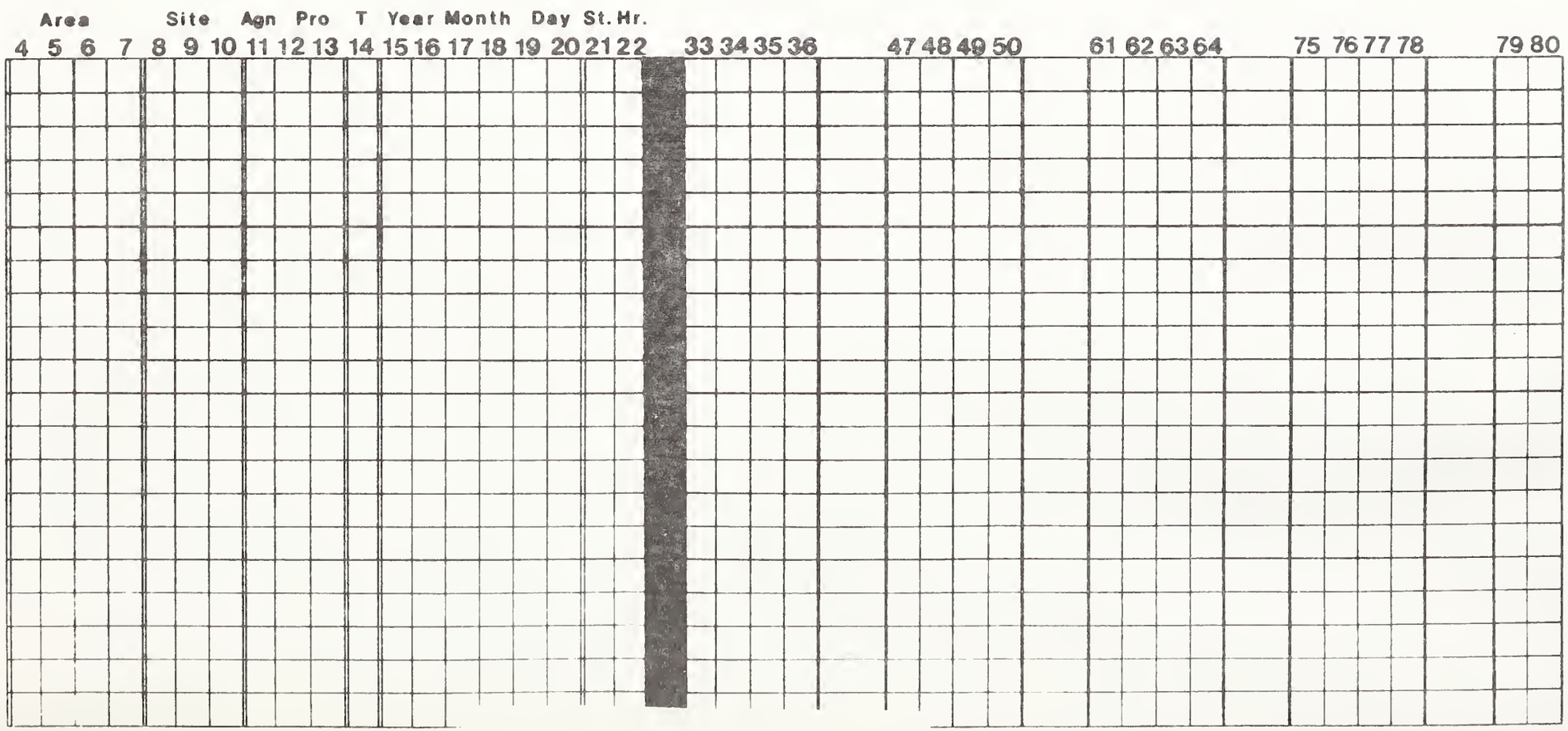


Figure AP-1-0

Form: 2179 Comments:

DATA INPUT FORM - 2179

MONTANA STATE DEPARTMENT OF HEALTH
AND ENVIRONMENTAL SCIENCES
Helena, Montana

State (2 3) Agency (11) Project (12 13) Time (14) Year (15 16) Period (month) (17 18) Number of Spls. (19 20) Comp Spl. Type Time (21 22)

2

Area Address

Collected By

Date Received Date Reported

Analyst

Comments or unusual activities:

Name PARAMETER Code (23 24 25 26 27) Method (28 29 30 31 32) Units (33 34 35 36) DP (4 3 2 1 0)

Name PARAMETER Code (37 38 39 40 41) Method (42 43 44 45 46) Units (47 48 49 50) DP (4 3 2 1 0)

Name PARAMETER Code (51 52 53 54 55) Method (56 57 58 59 60) Units (61 62 63 64) DP (4 3 2 1 0)

Name PARAMETER Code (65 66 67 68 69) Method (70 71 72 73 74) Units (75 76 77 78) DP (4 3 2 1 0)

Lab. No.	Sample No.	Location and Description	Date Out	Date In	Sampling Period	Area (4 5 6 7)	Site (8 9 10)

STATE DEPARTMENT OF HEALTH

AND ENVIRONMENTAL SCIENCES

HELENA, MONTANA

24-HOUR OR GREATER SAMPLING INTERVAL

2

1 Agency

City Name

Site Address

Project

Time Interval

State Area Site

2 3 4 5 6 7 8 9 10

Agency Pro. T. Year Month

11 12 13 14 15 16 17 18

Collection Day	Collection Lab. No.	Filter No.	Date Sample Logged	Operator	Total Volume Air (M3)	Unusual Circumstance *	Day	TSP Name PARAMETER Code 23 24 25 26 27	Method 28 29 30 31 32	Org Name PARAMETER Code 37 38 39 40 41	Method 42 43 44 45 46	As Name PARAMETER Code 51 52 53 54 55	Method 56 57 58 59 60	Pb Name PARAMETER Code 65 66 67 68 69	Method 70 71 72 73 74	Day	Cd Name PARAMETER Code 23 24 25 26 27	Method 28 29 30 31 32	Zn Name PARAMETER Code 37 38 39 40 41	Method 42 43 44 45 46	$SO_4^=$ Name PARAMETER Code 51 52 53 54 55	Method 56 57 58 59 60	Name PARAMETER Code 65 66 67 68 69	Method 70 71 72 73 74
19 20							19 20 21 22		28 29 30 31 32		42 43 44 45 46		56 57 58 59 60		70 71 72 73 74	19 20		28 29 30 31 32		42 43 44 45 46		56 57 58 59 60		70 71 72 73 74
01							01									01							
02							02									02							
03							03									03							
04							04									04							
05							05									05							
06							06									06							
07							07									07							
08							08									08							
09							09									09							
10							10									10							
11							11									11							
12							12									12							
13							13									13							
14							14									14							
15							15									15							
16							16									16							
17							17									17							
18							18									18							
19							19									19							
20							20									20							
21							21									21							
22							22									22							
23							23									23							
24							24									24							
25							25									25							
26							26									26							
27							27									27							
28							28									28							
29							29									29							
30							30									30							
31							31									31							

DP → 4 3 2 1 0 4 3 2 1 0 4 3 2 1 0 4 3 2 1 0 4 3 2 1 0 4 3 2 1 0 4 3 2 1 0 4 3 2 1 0

Comments or unusual circumstances

* codes 0 = excess of 24 hr. 5 = dry
1 = approx. 72°F 6 = clear
2 = approx. 32°F 7 = hazy
3 = rain 8 = calm
4 = snow 9 = windy

BAQ
3/72

Figure AP-3-0

DATA INPUT FORM - BAQ

LESS THAN 24-HOUR SAMPLING INTERVAL

AIR QUALITY BUREAU

[1] (1) Agency

City Name

Site Address

Project

Parameter observed

Method

Time interval of obs.

Units of obs.

State (2 3) Area (4 5 6 7) Site (8 9 10): 2 7

Agency (11) | Project (12 13) | Time (14) | Year (15 16) | Month (17 18)

Parameter code (23 24 25 26 27) | Method (28 29) | Units (30 31) | DP (32)

Day	St	Hr	Rdg 1	Rdg 2	Rdg 3	Rdg 4	Rdg 5	Rdg 6	Rdg 7	Rdg 8	Rdg 9	Rdg 10	Rdg 11	Rdg 12
(19 20)	(21 22)		(33 34 35 36)	(37 38 39 40)	(41 42 43 44)	(45 46 47 48)	(49 50 51 52)	(53 54 55 56)	(57 58 59 60)	(61 62 63 64)	(65 66 67 68)	(69 70 71 72)	(73 74 75 76)	(77 78 79 80)
01	00													
01	12													
02	00													
02	12													
03	00													
03	12													
04	00													
04	12													
05	00													
05	12													
06	00													
06	12													
07	00													
07	12													
08	00													
08	12													
09	00													
09	12													
10	00													
10	12													
11	00													
11	12													
12	00													
12	12													
13	00													
13	12													
14	00													
14	12													
15	00													
15	12													
16	00													

Figure AP-4-0

DATA INPUT FORM - SAROAD

FORM 2179

Col 1	Will always be coded 2, which indicates a 24-hour sample
Col 4-10	Area and site codes (different for each site, supplied by AQB)
Col 11	Agency code = J (indicates company, other letters indicate agencies)
Col 12, 13	Project code = 02 (or 07 is sampler is co-located)
Col 14	Time code = 8
Col 15-20	Year, month, day the sample was run (YY, MM, DD)
Col 21, 22	Start hour = 00 (for all TSP readings)
Col 23-27	Parameter code = 11101 for TSP
Col 28, 29	Method code = 91 for TSP
Col 30, 31	Unit code = 01 for TSP
Col 32	Decimal code = 0 or 1 depending on analysis - but be consistent
Col 33-36	Data
Col 37-46	Additional parameters
Col 47-50	Space for data for parameter in Col 37-46, and so on
Col 79	Blank
Col 80	Always coded 2 to indicate new data

SAROAD FORMS

These forms are numbered according to the days of the month. They are filled out similarly to 2179 with these exceptions:

Col 14	Time code = 1 for hourly data
Col 23-32	Parameter, method, unit, decimal depending on monitoring equipment. See Parameter Code Description Table.
Col 33-80	Data (for negative numbers, contact AQB for correct procedure)

PARAMETER CODE DESCRIPTION TABLE

Parameter	Code	Method	Units	Decimal	Method Description
TSP	11101	91	01	0	Gravimetric - $\mu g/m^3$
Lead	12128	90	01	2	ICAP - $\mu g/m^3$
Carbon Monoxide	42101	11	07	1	NonDispersive IR - ppm
Sulfur Dioxide	42401	20	07	3	Pulsed Fluorescent - ppm
Wind Speed	61101	50	11	1	Electronic Avg - meters/sec
	61101	40	12	1	Visual Avg - miles/hour
Wind Direction	61102	50	14	0	Electronic Avg - degrees
	61102	40	14	0	Visual Avg - degrees
Wind Deviation	61106	50	14	0	Electronic Avg - degrees
Temperature	62101	50	17	1	Electronic Avg - °Centrigrad
	62101	40	15	1	Machine Avg - °Fahrenheit

Additional parameter codes are available from the Air Quality Bureau.

APPENDIX P

Acronyms and Abbreviations

APPENDIX P

ACRONYMS AND ABBREVIATIONS

AA	Atomic absorption spectrophotometry
ACFM	Actual cubic feet per minute
ADP	Automatic data processing
AIRS	Aerometric Information Retrieval System
APCA	Air Pollution Control Association
APRAC	Urban diffusion model for CO
AQB	Air Quality Bureau
AQCR	Air Quality Control Region
AQDHS	Air Quality Data Handling System
AQDM	Air Quality Display Model
AQMA	Air Quality Maintenance Area
ARM	Administrative Rules of Montana
As	Arsenic
ASTM	American Society for Testing Materials
BACT	Best Available Control Technology
B(a)P	Benzo-(a)-pyrene
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CALINE	California Line Model for CO
Cd	Cadmium
CDHS	Comprehensive Data Handling System
CDM	Climatological Dispersion Model
CEMS	Continuous emission monitoring system
CFR	Code of Federal Regulations
CO	Carbon monoxide
CO_2	Carbon dioxide
CRM	Certified Reference Material
CRSTER	Single source meteorological model
Cu	Copper
DAS	Data aquisition system
DHES	Department of Health & Environmental Sciences
DHS	Data handling system
DNRC	Department of Natural Resources and Conservation
DSCF	Dry standard cubic feet
DSL	Department of State Lands
EA	Environmental assessment
EIC	Environmental Information Center
EIS	Environmental Impact Statement
EIS/P&R	Emission Inventory System/Permits and Registration
EPA	United States Environmental Protection Agency
EQC	Environmental Quality Council
ESD	Environmental Sciences Division
ESP	Electrostatic precipitator
ES&T	Environmental Science and Technology

F	Fluorine (fluoride)
FAA	Federal Aviation Administration
FBC	Fluidized bed combustion
FGD	Flue gas desulfurization
FID	Flame ionization detector
FPD	Flame photometric detector
G or (g)	Grams
GC	Gas chromatography
GR or (gr)	Grains
HC	Hydrocarbons
HF	Hydrofluoric acid
HIWAY	Meteorological model for CO
HPLC	High performance liquid chromatography
H_2O	Water
H_2S	Hydrogen sulfide
H_2SO_4	Sulfuric acid
ICP/ICAP	Inductively Coupled Plasma; Inductive Coupled Argon Plasma
I/M	Inspection and maintenance
IP	Inhalable particulates
ISC	Industrial Source Complex model
JAPCA	Journal of Air Pollution Control Association
LAER	Lowest Achieveable Emission Rate
M	Meter
M^3	Cubic meters
MAAQS	Montana Ambient Air Quality Standards Study
MAPS	Montana Air Pollution Study
MCA	Montana Codes Annotated
MCAA	Montana Clean Air Act
MEPA	Montana Environmental Policy Act
MHD	Magnetohydrodynamics
MS	Mass spectrometry
MCCHD	Missoula City-County Health Department
MO	Montana Office (EPA)
Mu	Micron
NA	Neutron activation or nonattainment
NAAQS	National Ambient Air quality Standards
NADB	National Aerometric Data Bank
NADP	National Atmospheric Deposition Program
NAMS	National Air Monitoring Station
NBS	National Bureau of Standards
NDIR	Nondispersive infrared analysis
NEDS	National Emission Data System
NEPA	National Environmental Policy Act
NESHAPS	National Emission Standards for Hazardous Air Pollutants

Ni	Nickel
NMHC	Non-methane hydrocarbons
NMR	Nuclear magnetic resonance
NOAA	National Oceanic and Atmospheric Administration
NOx	Oxides of nitrogen
NO_2	Nitrogen dioxide
NO_3	Nitrate
NPRC	Northern Plains Resource Council
NSPS	New Source Performance Standards
NTIS	National Technical Information Service
NWS	National Weather Sevice
O	Oxygen atom
O_2	Oxygen molecule
O_3	Ozone
PAL	Point, Area and Line Source air quality model
Pb	Lead
PBL	Planetary boundary layer
PER	Preliminary Environmental Review
PM	Preventive maintenance
PM10	Particulate matter less than 10 microns in diameter
PNA	Polynuclear aromatic hydrocarbon
POM	Polycyclic organic matter
PPM	Parts per million
PSD	Prevention of Significant Deterioration
PSI	Pollutant Standards Index or pounds per square inch
PTDIS	Single stack meteorological model
PTMAX	Single stack meteorological model
PTMTP	Multistack meteorological model
P&A	Precision and accuracy
QA	Quality assurance
RACT	Reasonably Available Control Technology
RAM	Urban Air Model for point and area sources
RP	Respirable particulates
S	Sulfur
SAMWG	Standing Air Monitoring Work Group
SAROAD	Storage and Retrieval of Aerometric Data
SI	International system of units
SIP	State Implementation Plan
SLAMS	State and Local Air Monitoring Station
SO_2	Sulfur dioxide
SO_4	Sulfate
SPM	Special Purpose Monitoring Station
SPSS	Statistical Package for the Social Sciences
SRM	Standard Reference Materials
SWMB	Solid Waste Management Bureau

TCM	Texas Climatological Model
THC	Total hydrocarbons
TLV	Threshold limit value
TRS	Total reduced sulfur
TSP	Total suspended particulate matter
$\mu G/M^3$ (or $\mu g/m^3$)	Micrograms per cubic meter
UNAMAP	User's Network for Applied Modeling of Air Pollution
USEPA	United States Environmental Protection Agency
V	Vanadium
VALLEY	Meteorological model for concentrations on elevated terrain
WQB	Water Quality Bureau
XRF	X-ray fluorescence
YCAPC	Yellowstone County Air Pollution Control
Zn	Zinc

APPENDIX Q

AQCR's and Area Codes

APPENDIX Q

AQCR'S AND AREA CODES

To facilitate the provisions of the Clean Air Act, the EPA divided the state into geographic areas or air quality control regions (AQCR). These are as follows:

AQCR	Name
140	Billings
141	Great Falls
142	Helena
143	Miles City
144	Missoula

Figure AP-1-Q shows the boundaries of Montana's five AQCR's on a map of the state.

Area codes for Montana are listed on Table AP-Q-I.

AQCR's and area codes are used by data users for requesting or processing data.

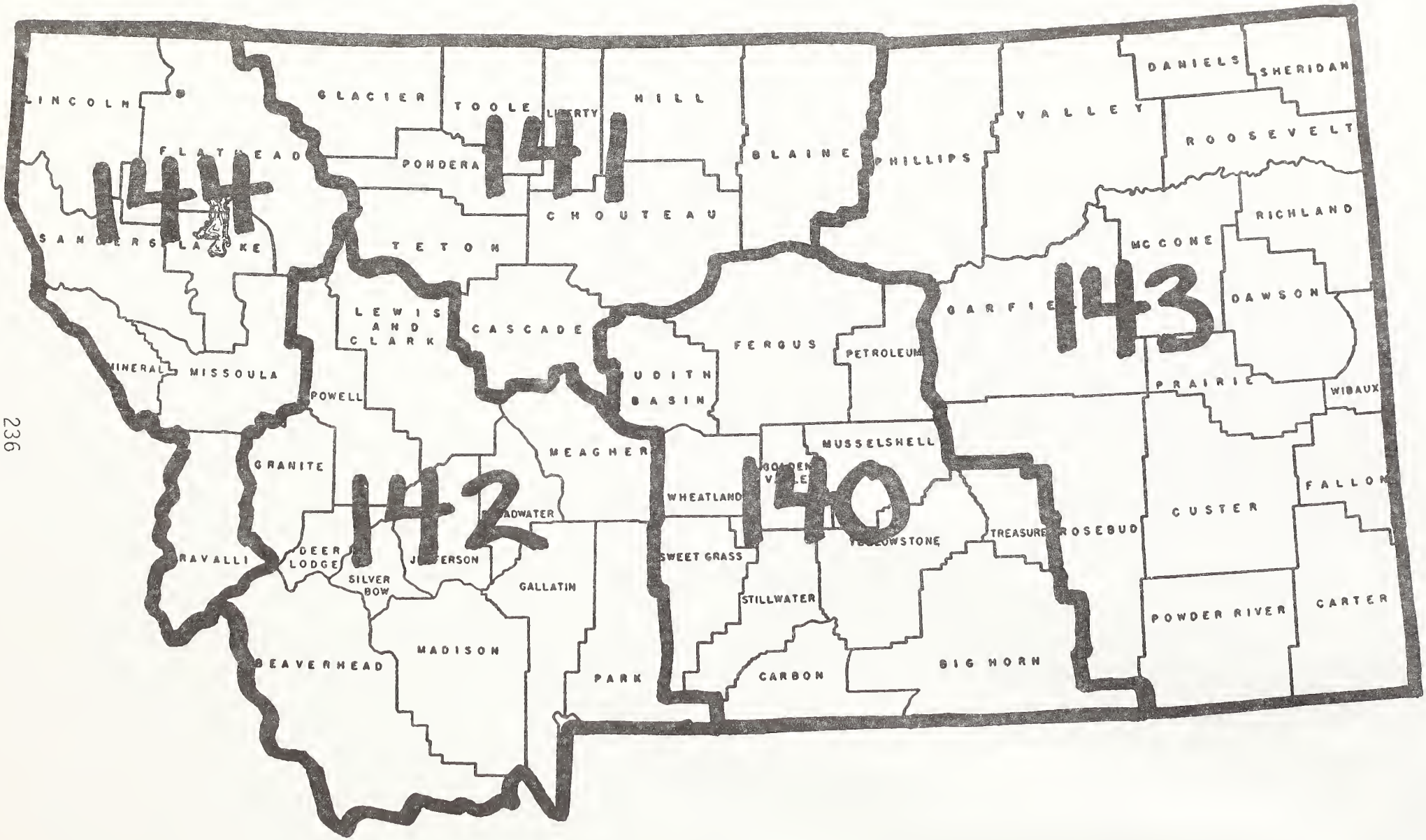


Figure AP-1-Q

MONTANA AIR QUALITY CONTROL REGIONS

Table AP-Q-I

MONTANA AREA CODES

0020 ANACONDA
0030 BAKER
0040 *BEAVERHEAD
0060 *BIG HORN
0080 BILLINGS

0100 *BLAINE
0120 BOZEMAN
0140 *BROADWATER
0160 BUTTE
0180 *CARBON

0200 *CARTER
0220 *CASCADE
0240 CENTERVILLE DUBLIN GULCH
0260 *CHOUTEAU
0270 COLUMBIA FALLS

0280 CONRAD
0300 *CUSTER
0320 CUT BANK
0340 *DANIELS
0360 *DAWSON

0380 DEER LODGE
0400 *DEER LODGE
0420 DILLON
0440 *FALLON
0460 *FERGUS

0480 *FLAT HEAD
0500 FLORAL PARK
0520 *GALLATIN
0540 *GARFIELD
0560 *GLACIER

0570 GLACIER NAT PARK
0580 GLASGOW
0600 GLENDIVE
0620 *GOLDEN VALLEY
0640 *GRANITE

0660 GREAT FALLS
0670 HAMILTON
0680 HARDIN
0700 HAVRE
0720 HELENA

0740 *HILL
0760 *JEFFERSON
0780 *JUDITH BASIN
0800 KALISPELL
0820 *LAKE

0840 LAUREL
0860 *LEWIS AND CLARK
0880 LEWISTOWN
0900 LIBBY
0920 *LIBERTY

0940 *LINCOLN
0960 LIVINGSTON
0980 *MC CONE
1000 *MADISON
1010 MALMSTROM

1020 *MEAGHER
1040 MILES CITY
1060 *MINERAL
1080 MISSOULA
1085 MISSOULA SOUTH

1090 MISSOULA WEST
1100 *MISSOULA
1140 *MUSSELSHELL
1160 *PARK
1180 *PETROLEUM

1200 *PHILLIPS
1220 *PONDERA
1240 *POWDER RIVER
1260 *POWELL
1280 *PRAIRIE

1300 *RAVALLI
1320 *RICHLAND
1340 *ROOSEVELT
1360 *ROSEBUD
1380 ROUNDUP

1400 *SANDERS
1420 SHELBY
1440 *SHERIDAN
1460 SIDNEY
1480 *SILVER BOW

1500 SILVER BOW PARK
1520 *STILLWATER
1540 *SWEET GRASS
1560 *TETON
1580 *TOOLE

1600 *TREASURE
1620 *VALLEY
1640 *WHEATLAND
1660 WHITEFISH
1680 *WIBAUX

1700 WOLF POINT
1720 *YELLOWSTONE
1740 YELLOWSTONE NAT PARK

INTERNATIONAL ATOMIC WEIGHTS 1961

BASED ON CARBON-12

	Symbol	Atomic Number	Atomic Weight
Actinium	Ac	89	[227] *
Aluminum	Al	13	26.9815
Americium	Am	95	[243] *
Antimony	Sb	51	121.75
Argon	Ar	18	39.948
Arsenic	As	33	74.9216
Astatine	At	85	[210] *
Barium	Ba	56	137.34
Berkelium	Bk	97	[249] *
Beryllium	Be	4	9.0122
Bismuth	Bi	83	208.980
Boron	B	5	10.811 [a]
Bromine	Br	35	79.909 [b]
Cadmium	Cd	48	112.40
Calcium	Ca	20	40.08
Californium	Cf	98	[251] *
Carbon	C	6	12.01115 [a]
Cerium	Ce	58	140.12
Cesium	Cs	55	132.905
Chlorine	Cl	17	35.453 [b]
Chromium	Cr	24	51.996 [b]
Cobalt	Co	27	58.9332
Copper	Cu	29	63.54
Curium	Cm	96	[247] *
Dysprosium	Dy	66	162.50
Einsteinium	Es	99	[254] *
Erbium	Er	68	167.26
Europium	Eu	63	151.96
Fermium	Fm	100	[253] *
Fluorine	F	9	18.9984
Francium	Fr	87	[223] *
Gadolinium	Gd	64	157.25
Gallium	Ga	31	69.72
Germanium	Ge	32	72.59
Gold	Au	79	196.967
Hafnium	Hf	72	178.49
Helium	He	2	4.0026
Holmium	Ho	67	164.930
Hydrogen	H	1	1.00797 [a]
Indium	In	49	114.82
Iodine	I	53	126.9044
Iridium	Ir	77	192.2
Iron	Fe	26	55.847 [b]
Krypton	Kr	36	83.80
Lanthanum	La	57	138.91
Lead	Pb	82	207.19
Lithium	Li	3	6.939
Lutetium	Lu	71	174.97
Magnesium	Mg	12	24.312
Manganese	Mn	25	54.9380
Mendelevium	Md	101	[256] *
Mercury	Hg	80	200.59
Molybdenum	Mo	42	95.94
Neodymium	Nd	60	144.24
Neon	Ne	10	20.183
Neptunium	Np	93	[237] *
Nickel	Ni	28	58.71
Niobium	Nb	41	92.906
Nitrogen	N	7	14.0067
Nobelium	No	102	[254] *
Osmium	Os	76	190.2
Oxygen	O	8	15.9994 [a]
Palladium	Pd	46	106.4
Phosphorus	P	15	30.9738
Platinum	Pt	78	195.09
Plutonium	Pu	94	[242] *
Polonium	Po	84	[210] *
Potassium	K	19	39.102
Praseodymium	Pr	59	140.907
Promethium	Pm	61	[147] *
Protactinium	Pa	91	[231] *
Radium	Ra	88	[226] *
Radon	Rn	86	[222] *
Rhenium	Re	75	186.2
Rhodium	Rh	45	102.905
Rubidium	Rb	37	85.47
Ruthenium	Ru	44	101.07
Samarium	Sm	62	150.35
Scandium	Sc	21	44.956
Selenium	Se	34	78.96
Silicon	Si	14	28.086 [a]
Silver	Ag	47	107.870 [b]
Sodium	Na	11	22.9898
Strontium	Sr	38	87.62
Sulfur	S	16	32.064 [a]
Tantalum	Ta	73	180.948
Technetium	Tc	43	[99] *
Tellurium	Te	52	127.60
Terbium	Tb	65	158.924
Thallium	Tl	81	204.37
Thorium	Th	90	232.038
Thulium	Tm	69	168.934
Tin	Sn	50	118.69
Titanium	Ti	22	47.90
Tungsten	W	74	183.85
Uranium	U	92	238.03
Vanadium	V	23	50.942
Xenon	Xe	54	131.30
Ytterbium	Yb	70	173.04
Yttrium	Y	39	88.905
Zinc	Zn	30	65.37
Zirconium	Zr	40	91.22

175 copies of this public document were published at an estimated cost of $10.57 per copy, for a total cost of $1,850.00 which includes $1,650.00 for printing and $200.00 for distribution.